



## An annotated checklist of species in the family Lagenophryidae (Ciliophora, Oligohymenophorea, Peritrichia), With a brief review of their taxonomy, morphology, and biogeography

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### Abstract

The genera *Lagenophrys* Stein, 1852, *Paralagenophrys* Clamp, 1987, *Clistolagenophrys* Clamp, 1991, and *Operculigera* Kane, 1969 make up the family Lagenophryidae and, together, contain more than 80 species worldwide that live mainly as ectosymbionts of crustaceans. Lagenophryids are characterized by possession of a lorica, but the lorica aperture and the associated parts of the body differ between genera. Despite their widespread distribution, relatively few papers have been published on lagenophryids in recent years, and the present paper is intended to promote research on lagenophryids by providing an annotated checklist of all known species and a brief review of the family, including data of their geographic distribution and their hosts.

**Key words:** Peritrichs, lagenophryids, crustacean ectosymbiont, lorica

### Introduction

Peritrichs are a large subclass<sup>1</sup> (Zhan *et al.* 2009) of ciliated protists (~1000 known species) in which the usually sessile trophonts live as stationary suspension feeders. Most taxa of peritrichs are highly specialized for a variety of ecological niches in terms of both their morphology and morphogenesis. Within this diverse assemblage, the family Lagenophryidae stands out as having exceptional morphological, reproductive, and developmental adaptations for living as obligate ectosymbionts of crustaceans.

More than 80 species of lagenophryids have been discovered on a diverse array of crustacean hosts, including decapods (crayfish, crabs, shrimp), amphipods, isopods, copepods, ostracods and cladocerans (Clamp 2006). Lagenophryids are relatively well-known, and many papers on their systematics, distribution, and biology have been published since their discovery by Stein (1852). However, relatively few papers have been published on lagenophryids in recent years (Clamp 2006; Mayén-Estrada & Aguilar-Aguilar 2012), and they represent an untapped potential in terms of their use as model organisms to investigate questions in the areas of phylogenetics, population genetics, morphogenesis, mechanisms of dispersal, and biogeography.

One factor that certainly prevents lagenophryids from receiving more attention is the rather demanding requirement that investigators must be equally familiar with the biology and habits of the crustacean hosts and their symbionts. The solution is either deliberate cross-training of graduate students or postdoctoral fellows to give them the ability to conceive and carry out research on symbiotic ciliates like lagenophryids or collaboration between

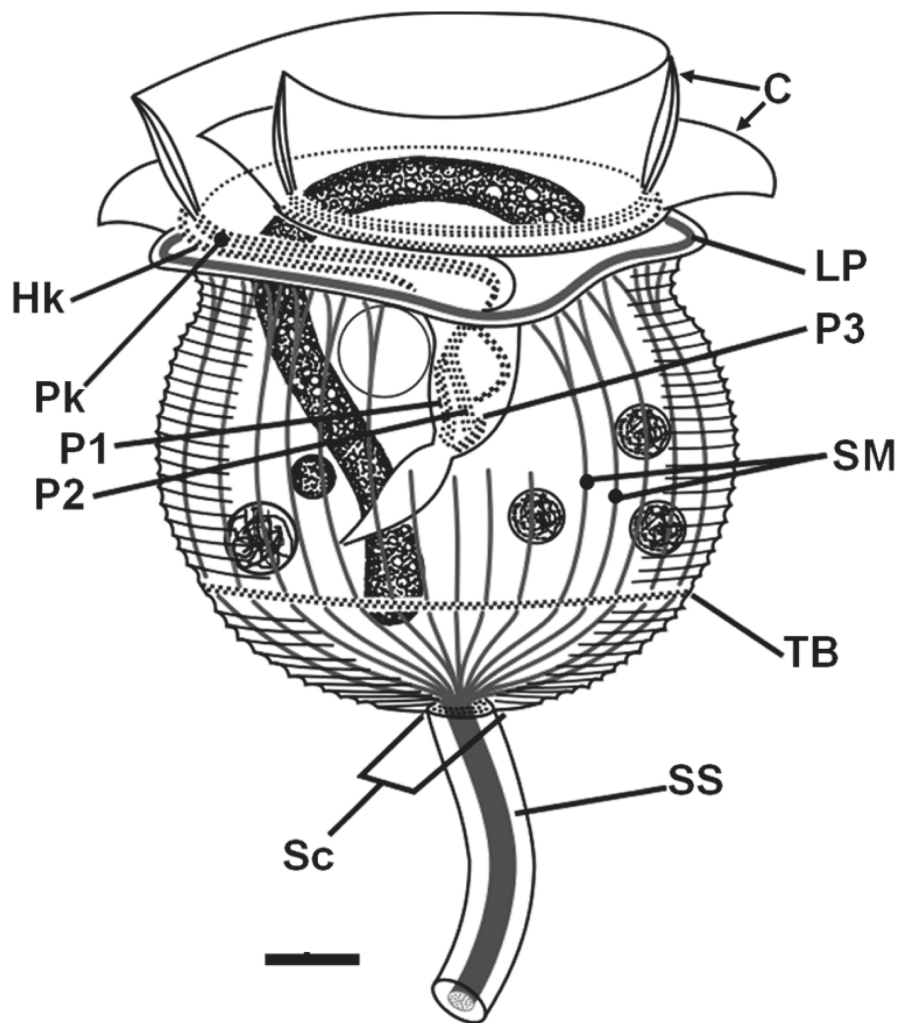
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1. For the purposes of this paper, we have chosen to accept the proposal of Zhan *et al.* (2009) that mobilids are a distinct subclass separate from peritrichs; therefore, the present paper considers the Peritrichia s. str. to be those taxa formerly placed within the order Sessilida.

researchers with complementary backgrounds and skills. The present paper is intended to promote research on lagenophryids by providing an annotated checklist of all known species and a brief review of the family to researchers with diverse backgrounds.

## Methodology

Geographic distribution and known hosts of each lagenophryid species were compiled from all available records in the literature. In some cases, we were able to use specific locality names and references to obtain the latitude and longitude coordinates using Google Earth™ maps. We verified the taxonomic names of crustaceans using web resources of WoRMS, the Carnegie Museum of Natural History, and the Crustacean Society.



**FIGURE 1.** Gross anatomy of peritrichs. *Vorticella* sp., a typical peritrich ciliate presented for comparison with lagenophryids. Redrawn from an unpublished drawing by Eugene B. Small. Abbreviations: C, peristomial cilia (shown in outline); Hk, haplokinety; LP, peristomial lip (dark band in interior is myoneme that constricts the lip over the peristome upon contraction); Pk, peristomial polykinety; P1, infundibular polykinety 1; P2, infundibular polykinety 2; P3, infundibular polykinety 3; SM, somatic myonemes; Sc, scopula; SS, stalk spasmoneme; TB, trochal band. Scale bar, 10µm.

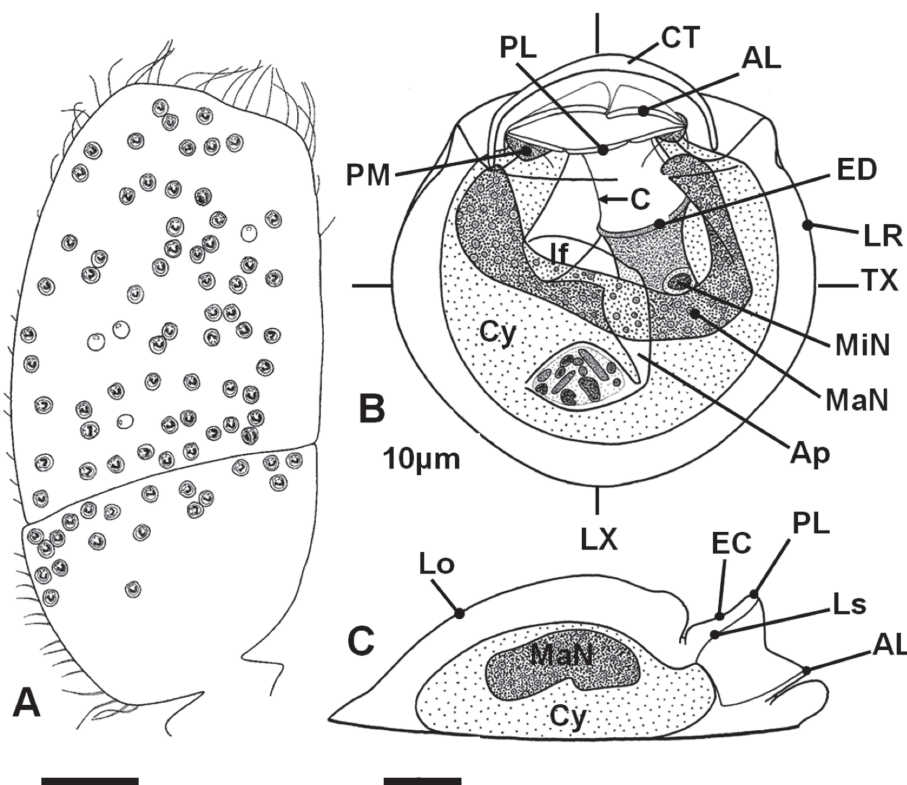
## Characteristics of the Family Lagenophryidae

Possession of a lorica distinguishes members of the Lagenophryidae, Usconophryidae, Vaginicolidae, and Rovinjellidae from other peritrichs. Loricae of peritrichs are composed of semirigid extracellular material secreted

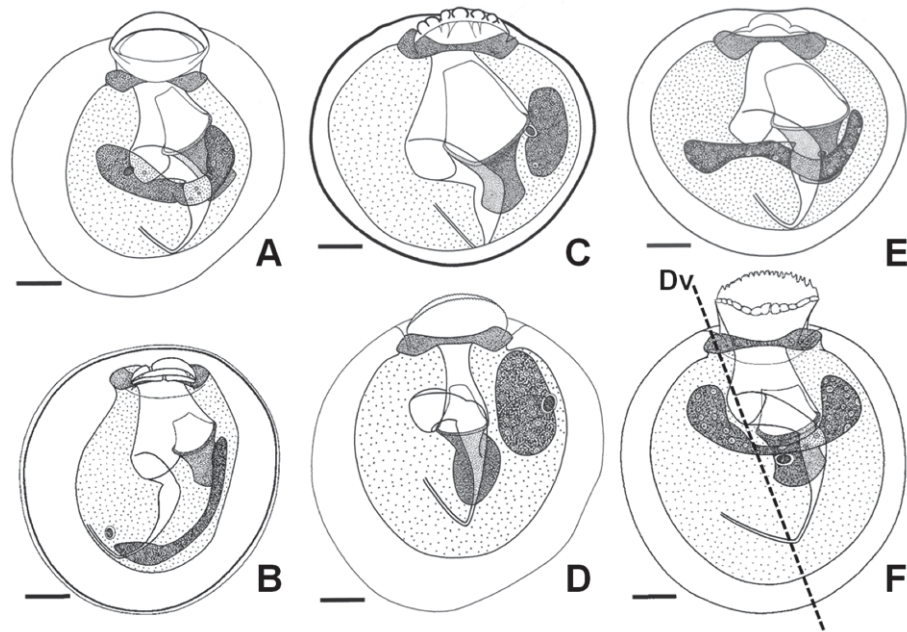
around the body during attachment of the cell to a substrate (Clamp 1984). They are usually thin-walled and transparent or nearly so. Thickened parts of a lorica are relatively rigid, but thin areas are flexible to varying degrees.

Lagenophryids are distinguished from other loricate peritrichs by the following characteristics:

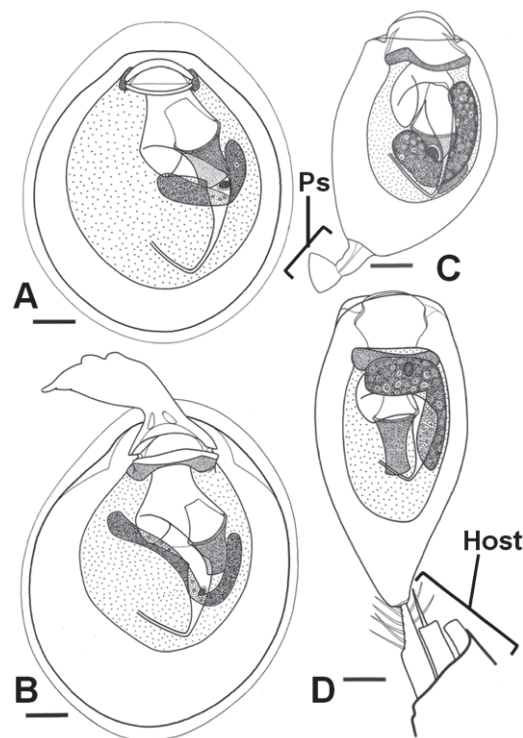
- **The lorica aperture and parts of the body associated with it form an elaborate closure apparatus for the lorica that is operated by a prominent band of myonemes** (Fig. 2B, PM; 2B; 3A–F; 4A–D; 5B; 9A). Usconophryids and rovinjellids have no means of closing the lorica aperture. Members of two vaginicolid genera (*Pyxicola*, *Thuricola*) form structures out of lorica material that block entrance to the lorica when the organism contracts (Trueba 1978, 1980); however, these structures are fundamentally different from the closure apparatus of lagenophryids (Clamp 1984). The anterior and posterior edges of the lorica aperture are folded to form two opposable lips in all lagenophryids except *Operculigera* (Clamp & Kane 2003), and the loricastome, a sleeve-like structure, extends into the lorica from the ventral edges of these lips (Fig. 2C). The inner rim of the loricastome is thus the true lorica aperture in these genera.
- **The cell body is grossly flattened along its oral-aboral axis and laterally distorted to give it bilateral symmetry** (compare Fig. 1 to Fig. 2B–C) rather than the radial symmetry typical of peritrichs (including vaginicolids and rovinjellids among the loricate forms). *Usconophrys* is flattened and, thus, superficially similar to lagenophryids; however, it lacks a closure apparatus for the lorica and the radically different orientation of its division plane marks its bilateral symmetry as a convergently evolved feature (Clamp 1991).
- **Attachment to the substrate is by means of the base of the lorica.** This is also a (presumably convergent) characteristic of usconophryids. By contrast, the majority of peritrichs, including rovinjellids and most vaginicolids among loricate taxa, secrete a cylindrical stalk of some sort to attach themselves to a solid substrate (Clamp & Kane 2003).



**FIGURE 2.** Characteristics of *Lagenophrys*. A. *L. aselli* on surface of pleopod of freshwater isopod. B. *Lagenophrys ampulla*, a typical representative of the genus, dorsal view. C. *Lagenophrys labiata*, lateral view. A, from Clamp 1988b; B–C, from Clamp 1991. Abbreviations: Ap, ampulla of cytostome (the cytopharynx leading into the cytoplasm is distended with a food vacuole); AL, anterior lip of lorica aperture; C, peristomial cilia (shown in outline); CT, crescentic thickening in wall of lorica anterior to lorica aperture; Cy, cytoplasm; EC, external collar of lorica aperture; ED, epistomial disk; If, infundibulum; Lo, dorsal wall of lorica; LR, rim of lorica; Ls, loricastome; LX, longitudinal axis of organism; MaN, macronucleus; MiN, micronucleus; PL, posterior lip of lorica aperture; PM, myoneme in edge of peristomial lip; TX, transverse axis of organism.

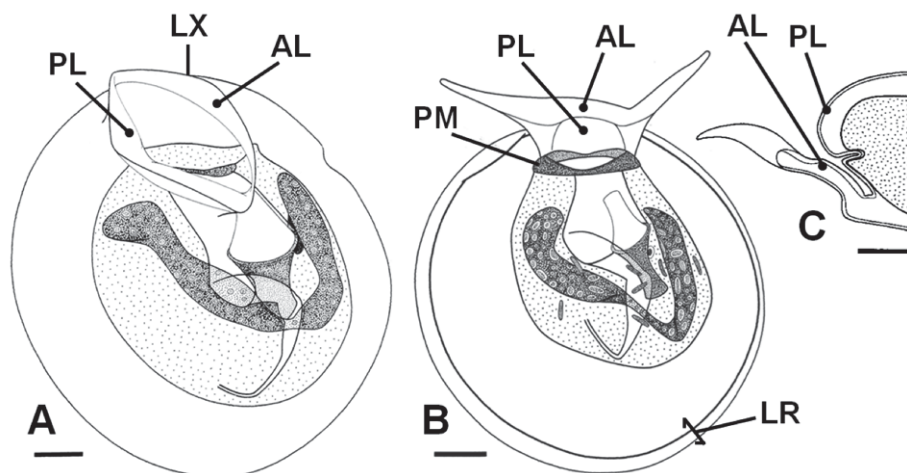


**FIGURE 3.** Dorsal views of six species of *Lagenophrys* illustrating interspecific diversity in characteristics of the lorica, especially the aperture, and the shape and position of the macronucleus. A. *L. crutchfieldi*. B. *L. callinectes*. C. *L. novazealandae*. D. *L. matthesi*. E. *L. branchiarum*. F. *L. nassa*. A, from Clamp, 1993; B, from Clamp, 1989; C, from Clamp, 1994; D–F, from Clamp, 1984. Abbreviation: Dv, plane of division. All scale bars = 10µm.



**FIGURE 4.** Diversity of *Lagenophrys* spp. Intraspecific variation and adaptation for attachment to setae. A, B. Two morphs in a population of *L. machaerigera* that represent the extreme range of variation in outgrowth of the anterior lip of the lorica aperture and thickening of the posterior lip. C. Dorsal view of *L. lenticula*, which attaches to setae of the amphipod *Hyaella* with a posterior prolongation of the lorica (Ps, pseudostalk). D. Dorsal view of *L. vaginicola*, which attaches to caudal setae of harpacticoid copepods. A, from Clamp 1992; B–D, from Clamp 1991. All scale bars = 10µm.





**FIGURE 5.** Characteristics of *Paralagenophrys* and *Setonophrys*. A, Dorsal view of *P. singularis*. B, dorsal view of *S. communis*. C, lateral view of *S. seticola* showing contraction of the posterior lip of the lorica aperture against the rigid anterior lip to close the aperture. A, from Clamp 1987b; B–C, from Clamp 1991. Abbreviations: AL, anterior lip of lorica aperture; LR, rim of lorica; LX, longitudinal axis of organism; PL, posterior lip of lorica aperture; PM, myoneme in edge of peristomial lip. All scale bars = 10µm.

## Genera of Lagenophryids

Five genera are currently recognized in the family Lagenophryidae. They are characterized by fundamental differences in the lorica aperture as well as other structural and developmental features (Table 1).

- *Lagenophrys* Stein, 1852 is the largest genus, with 62 known species. The lorica is usually hemispheroidal (Fig. 2–3) but is ovoid (Fig. 4) in a few species as an adaptation for attaching to setae of the host<sup>1</sup>. The lorica aperture is an invaginated tube (loricistome) closed by drawing the outer edges (lips) together (Fig. 2B–C). Characteristics of the lorica aperture, especially the lips, are remarkably diverse among species of *Lagenophrys* (Fig. 4). Details of the lorica aperture are species-specific and, usually, show relatively little intraspecific variation (Clamp 1990); however, the lips of the lorica aperture are highly variable in a few species (Clamp 1990, 1992). Other than their distinctive lorica aperture, members of *Lagenophrys* are unique in undergoing a special sequence of asexual divisions (second-type division) to abandon the exoskeleton of the host.
- *Paralagenophrys* Clamp, 1987 (Fig. 5) has a lorica aperture that is similar to that of *Lagenophrys*, but its body and lorica aperture are twisted obliquely clockwise. The result is a lorica aperture that is displaced nearly 90° to the right and aligned almost parallel to the long axis of the body. The single species of *Paralagenophrys* is the only lagenophryid that is not restricted to a crustacean host. It also occurs on aquatic vascular plants and animals other than crustaceans (e.g., pulmonate snails) (Clamp 1987b).
- The genus *Clistolagenophrys* was created by Clamp (1991) for *Lagenophrys primitiva*, which occurs on one of the endemic species of amphipods in Lake Baikal, Russia (Swarczewsky 1930), because closure of its lorica aperture appears to be effected by a markedly different mechanism than in *Lagenophrys* (Fig. 6). *Clistolagenophrys primitiva* retracts the entire loricistome within the lorica to close the aperture with its basal edges instead of pulling the lips together

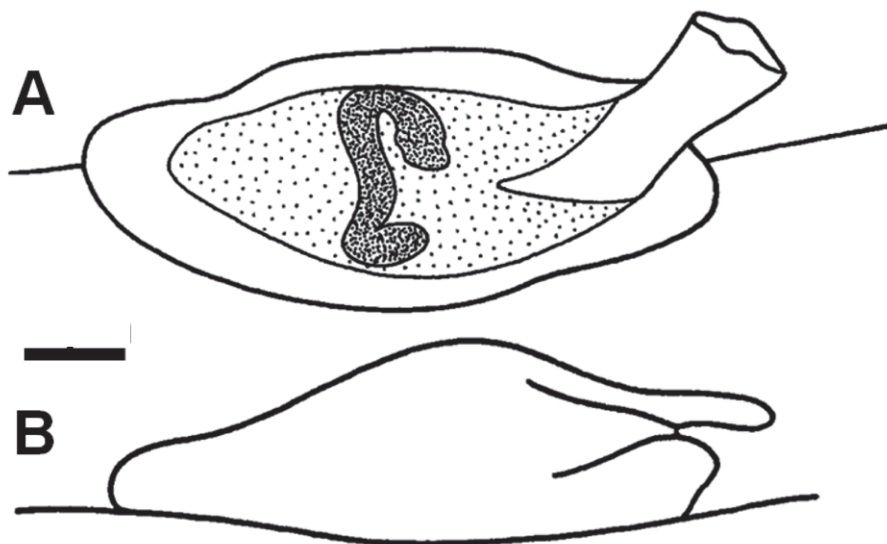
1. Elongate species of *Lagenophrys*, in which the posterior part of the lorica produced to form a slender ‘pseudostalk’ for attachment to setae, were formerly placed in the genus *Stylohedra*. However, Clamp (1991) determined that this single feature was not sufficient to characterize a genus and, in addition, had almost certainly evolved more than once within the genus *Lagenophrys* as well as in two other lagenophryid genera.

(Swarzewsky 1930). Jankowski (1993) maintained that the lorica aperture of *C. primitiva* was not fundamentally different from that of *Lagenophrys*; however, he offered no evidence to support this assertion.

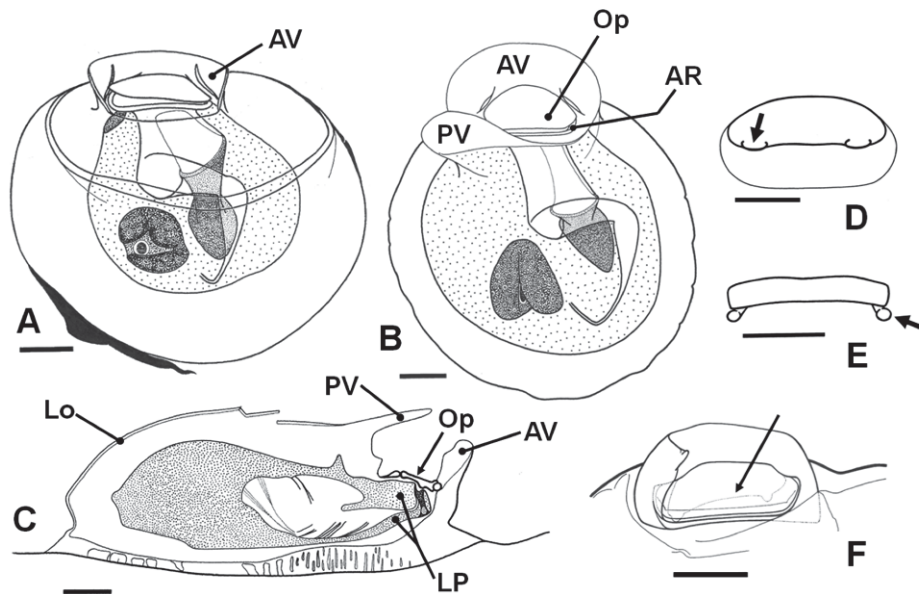
- The diagnosis of *Setonophrys* Jankowski (1986) was emended by Clamp (1991) to include all lagenophryid species that have a lorica aperture with a rigid anterior lip and a flexible posterior lip that is pulled completely inside the lorica to press it against the anterior lip and close the aperture (Fig. 5).
- The lorica aperture of *Operculigera* Kane, 1969 is a simple opening in the lorica wall rather than an invaginated loricastome (Fig. 7), and the aperture is closed by a flexible flap of lorica material (operculum) rather than a pair of lips (Clamp 1991; Clamp & Kane 2003).

**TABLE 1.** Characteristics of lagenophryid genera.

Genus	Type of aperture	Orientation of lips of aperture	Closure apparatus	Mechanism of closure	Peristomial myoneme
<i>Lagenophrys</i>	loricastome	perpendicular to long axis of body	opposing lips; both flexible	edges of lips meet	posterior half thickened
<i>Paralagenophrys</i>	loricastome	at oblique angle to long axis of body	opposing lips; both flexible	edges of lips meet	posterior half thickened; left more than right
<i>Clistolagenophrys</i>	loricastome	perpendicular to long axis of body	opposing lips; both flexible	bases of lips meet	(not described)
<i>Setonophrys</i>	loricastome	perpendicular to long axis of body	opposing lips; only posterior flexible	base of posterior lip meets inner face of anterior lip	entire myoneme thickened
<i>Operculigera</i>	simple opening	(not applicable)	flap-like operculum	operculum covers aperture	anterior half thickened



**FIGURE 6.** Characteristics of *Clistolagenophrys*, from Clamp 1991. A, Lateral view of individual with lorica aperture in open position; B, Lateral view of lorica with lorica aperture retracted and closed. Scale bars= 10µm.



**FIGURE 7.** Characteristics of *Operculigera*. A, Dorsal view of *O. montanea*; B, Dorsal view of *O. asymmetrica*; C, Sagittal section of *O. asymmetrica*; D, Ventral view of operculum of *O. insolita*; E, Frontal view of operculum of *O. seticola*; F, Dorsal view of the anterior part of the lorica of *O. madagascarensis* showing the thickened ventral part of the operculum (see D, F) in outline (thin arrow). A–E, from Clamp 1991; F, from Clamp 1992. Abbreviations: AV, anterior half of vallum; AR, rim of aperture; Lo, dorsal wall of lorica; LP, peristomial lip; Op, operculum; PV, posterior half of vallum; thick arrow, knob-like thickening on ventral surface of operculum that is gripped by the edge of the peristomial lip. All scale bars = 10 μm.

## Cellular Anatomy and Taxonomic Characters

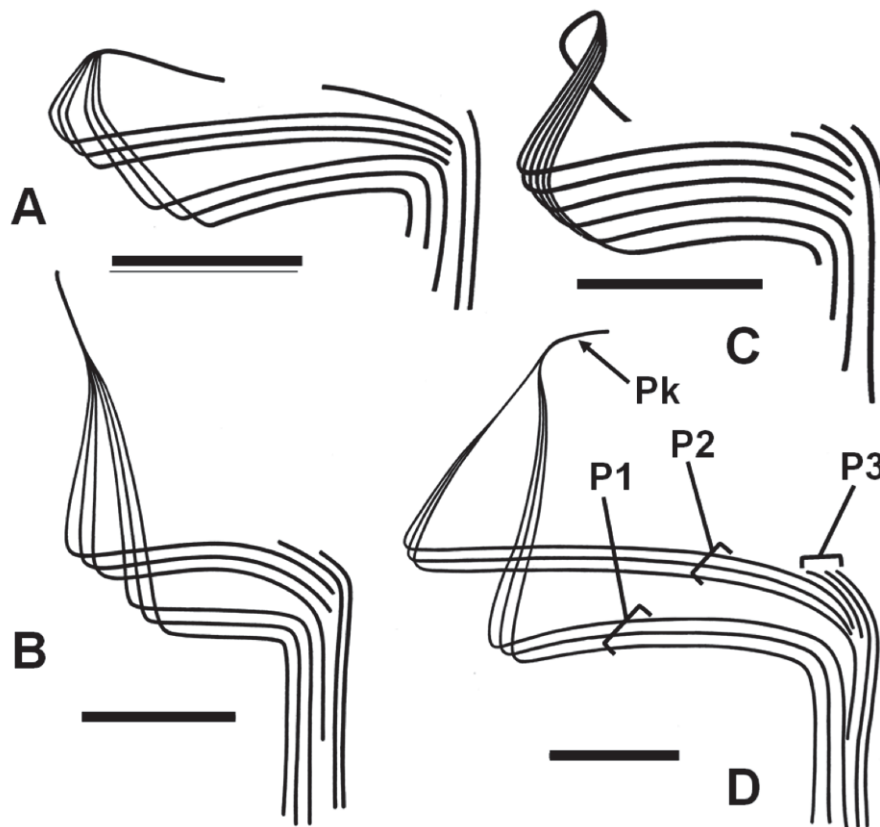
Lagenophryids have the same fundamental cellular anatomy as other peritrichs (Fig. 1), despite their flattened, distorted, discoid body. Owing to their superficially bilateral symmetry, a special anatomical terminology (Fig. 1B, C) has come into use for lagenophryids (Kane 1965). Like all peritrichs, lagenophryids are organized around a peristome (expanded oral area for suspension feeding) and an aboral scopula (circular field of pores interspersed with stereocilia that usually secretes a stalk) (Clamp 1984). The peristome consists of a central part, the epistomial disk, surrounded by a circular peristomial lip. In most peritrichs, the peristomial lip is a symmetrical, raised or flexible rim, enabling it to draw together on all sides like a sphincter to close over the retracted epistomial disk when the cell contracts. By contrast, the lagenophryid peristomial lip is asymmetrical, being physically bonded to the aperture of the lorica on one side to form a structural element for closure and, as a consequence, unable to contract in the typical way during extension or retraction of the epistomial disk (Clamp & Kane 2003) (Fig. 1B). Lagenophryids are able to extend only the epistomial disk out of the lorica aperture because of the association of the peristomial lip with the lorica aperture.

In *Lagenophrys*, approximately the dorsal one-half of the peristomial lip grasps the lower, posterior part of the loricastome (Fig. 2C). The segment of the circular myoneme (peristomial sphincter) in this portion of the peristomial lip is enlarged to form a prominent, thick band of myonemes (Fig. 1B) that spans the entire posterior half of the loricastome and curls around its lateral creases. Couch (1971, 1973) found its fine structure resembles that described for the peristomial sphincter of other peritrichs (Fauré-Fremiet *et al.* 1962; Bradbury 1965; Lom & Corliss 1958). Contraction of the band closes the lorica aperture, probably by drawing the posterior half of the loricastome forward and down to pull the lips of the aperture together (Couch 1971).

The lorica aperture of *Operculigera* is radically different from that of other lagenophryid genera. The aperture is a simple opening, not an invaginated loricastome, and the closure is an oval flap that is attached to the anterior part of the lorica (Clamp & Kane 2003). The anterior half of this operculum is thickened ventrally in most species of *Operculigera* to create a ventral shelf with a rounded projection at each end (Clamp 1991). The anterior half of the peristomial lip appears to grip this shelf to provide the attachment necessary for drawing the operculum over the aperture to close it.

The aperture is enclosed partially or completely by a wall of thickened lorica material (vallum) in most species of *Operculigera* (Clamp 1991). The vallum can be quite tall in some species and sculptured into projecting spines or blades on parts of its edge. A few species of *Operculigera* have only the anterior half of the vallum fully developed, and some species of *Lagenophrys* have a semicircular thickening around the anterior half of the lorica aperture (Fig. 2B) that almost certainly represents a vestige of this structure (Clamp 1991). Furthermore, it appears that the anterior lip of the lorica aperture of *Setonophrys*, which is rigid and often bears spines on its edge, represents another homologue of the anterior half of the vallum (Clamp 1991).

The infraciliature of the oral complex shows the pattern typical of peritrichs (Couch 1973). Variations in the three infundibular polykineties (Fig. 8) are species-specific characteristics in peritrich ciliates and are relatively well-documented in *Lagenophrys*, *Paralagenophrys*, and *Operculigera*. One or more rows of infundibular polykinety 1 (P1) are longer or shorter than the others at their adstomal ends in some species of *Lagenophrys* and *Operculigera* (Clamp, 1990a, 1991, 1992, 1994), and the first row of P1 is slightly shorter than the others in the single species of *Paralagenophrys* (Clamp 1987b). The rows of P2 are equal in length in all species of *Lagenophrys*, but the first row of P2 is significantly longer than the other two rows at its adstomal end in most species of *Operculigera* (*O. carcini* is the exception) and in *P. singularis* (Clamp 1987b). The first row of P3 is extremely short in species of *Operculigera* and some species of *Lagenophrys* (Clamp 1991) and is absent in many other species of *Lagenophrys* and in *P. singularis* (Clamp 1987a, b, 1988). Loss of a row from P3 (i.e., reduction from a trikinety to a dikinety) also has been observed in the family Vorticellidae (Sun *et al.* 2006).



**FIGURE 8.** Infraciliature of the infundibular polykineties of lagenophryids (see fig. 1 for reference). A, *Lagenophrys labiata*. B, *L. discoidea*. C, *Paralagenophrys singularis*. D, *Operculigera parastacis*. A–B, from Clamp 1990a; C, from Clamp 1987b; D, from Clamp 1991. Abbreviations: P1, infundibular polykinety 1; P2, infundibular polykinety 2; P3, infundibular polykinety 3; Pk, peristomial polykinety. All scale bars = 5µm.

The trochal band of kinetosomes is a simple dikinety in lagenophryid trophonts (Clamp 1987a), which is typical for peritrichs. In trophonts of *L. callinectes* (Couch 1967, 1971, 1973) and *L. eupagurus* (Clamp 1989), the trochal band is broken on the right side, with the two ends of the break separated by a significant gap; however,



telotrochs of both species have a normal trochal band. The trochal band surrounds a scopula that occupies a large part of the body's aboral surface in lagenophryids (Clamp 1984). Couch (1971, 1973) found no secreted bond between the scopula of *L. callinectes* and the surface of the host's exoskeleton.

Lagenophryids have one macronucleus and micronucleus (Fig. 2B). All known species of *Setonophrys* have a distinctive, elongate, cyclindroid macronucleus that spans the width of the cell (Fig. 5B). By contrast, the shape, size, and location of the macronucleus vary widely among species of *Lagenophrys* and *Operculigera* (Clamp 1991). The macronucleus can be cylindroid, ovoid, or spheroid. If cylindroid, it may be slightly or sharply curved, bent at one or more points along its length, or relatively straight. More compact, ovoid or spheroid macronuclei are located on the right side of the cell in some species and on the left in others (Clamp 1987a, 1992). The variety of macronuclear shapes among species of *Lagenophrys* is unusual compared to the relative uniformity that is typical of other genera of peritrichs (e.g., *Setonophrys*). Even large genera such as *Vorticella* or *Zoothamnium* have evolved only a few different macronuclear shapes and orientations (Warren 1986; Ji *et al.* 2006). In general, macronuclear morphology is correlated with shape of the cell in ciliates, including peritrichs. One example would be vaginicolid peritrichs with elongate bodies and correspondingly long, cyclindroid macronuclei (Trueba 1978, 1980). There is no apparent functional reason for the diversity of macronuclear shapes in species of *Lagenophrys* and *Operculigera*, given that all of them have essentially the same discoid cell body.

In lagenophryids, the plane of division extends diagonally across the body from a point just to the left of the lorica aperture to the center of the posterior margin of the cell (Fig. 1B). Thus, the lateral distortion of the body causes the plane of division to be oriented generally parallel to the anteroposterior axis although it is actually homologous to the oral-aboral division plane of other peritrichs (Bütschli 1889; Couch 1971). Binary fission produces a right-hand daughter that remains associated with the lorica aperture to resume feeding after a short period of quiescence and a left-hand daughter that transforms into a telotroch, which must exit the lorica by squeezing through the lorica-stome via the small gap left by the unattached ventral edge of the other daughter's peristomial lip.

Lagenophryid telotrochs possess a number of specialized structures that are not seen in other peritrichs. The body of the telotroch is flattened like that of the trophont; consequently, its trochal band is entirely on the ventral surface of the body. Protargol preparations of lagenophryid trophonts do not reveal any evidence of the radial somatic myonemes that extend from the edge of the peristome to the scopula in other peritrichs, and this absence has been confirmed by transmission electron microscopy (Couch 1973). By contrast, lagenophryid telotrochs possess partial somatic myonemes that are inserted onto the adoral edge of the trochal band and extend only halfway toward the dorsal apex of the body; thus, they are not attached to the edge of the peristome as in other peritrichs. In addition, there are 3-4 partial myonemes attached to the periphery of the scopula that also extend dorsally instead of being attached to the aboral edge of the trochal band. This unique arrangement of somatic myonemes appears to play a part in the attachment of the telotroch to the host's exoskeleton, with the scopular myonemes raising the aboral pole of the body to create suction and hold the telotroch in place while the radial myonemes flatten the body in preparation for secretion of the lorica (Clamp 1987a). Finally, the telotroch's peristomial lip is distorted into the shape of the lips of the lorica aperture and, presumably, plays a part in shaping them during secretion of the lorica.

## Ecology of Lagenophryids

*Paralagenophrys singularis* Kellicott is the only member of the Lagenophryidae that shows no preference for a particular host or substrate (Clamp 1989). Other lagenophryids appear to be restricted to a single species, genus, or family of crustaceans (Clamp 1990b, 1992). Furthermore, many species are confined to one part of the host, such as its gills, locomotory appendages, maxillipeds, or antennae (Fig. 2A). Relatively few species occur on all parts of a host, and even these settle more thickly on some areas of the host's body than others (Shomay 1955; Jakschik 1967b; Clamp 1973). Most authors who have concerned themselves with relationships of lagenophryid species to their hosts (Abonyi 1928; Mouchet-Bennati 1931, 1932a, 1932b; Shomay 1953b, 1955; Couch 1965, 1967, 1991; Clamp 1972, 1973) agree that lagenophryids have little or no effect upon their hosts even though they may be present in great numbers (Felgenhauer & Ridgeway 1977). Abonyi (1928), however, proposed that two species of *Lagenophrys* found on semiterrestrial crustaceans are ectoparasites subsisting on the tissues of their hosts but

offered no supporting evidence. Couch (1966) reported heavy populations of *L. callinectes* on gills of moribund *Callinectes sapidus* held in crowded, stagnant conditions.

The forceful currents created by the host's respiratory and locomotory movements are probably the feature of crustaceans that is of critical benefit to lagenophryids. Fenchel (1965) and Clamp (1973) demonstrated that particles of food torn up by the mouthparts of a host animal are carried by such currents to lagenophryids on other areas of its body, and the ciliates also captured particles that are swept from the surrounding water into currents created by the host.

Ectosymbionts of crustaceans face a periodic loss of habitat caused by ecdysis of their hosts and have evolved various means of dealing with it. Members of *Lagenophrys* are unique among ciliates that are ectosymbiotic on crustaceans because they undergo a special type of binary fission just before their host's ecdysis. Called second-type division by Willis (1942), this process usually consists of two divisions of an adult without an intervening period of growth. The first division is identical to normal binary fission, but the second is grossly unequal (Willis 1942). The result is two telotrochs of normal size and a small, poorly developed third daughter (residual organism) that remains associated with the lorica aperture, never develops recognisable oral structures, contains only fragments of nuclear material, and dies soon after ecdysis. Willis (1942) also observed a form of second-type division in which only one unequal division took place.

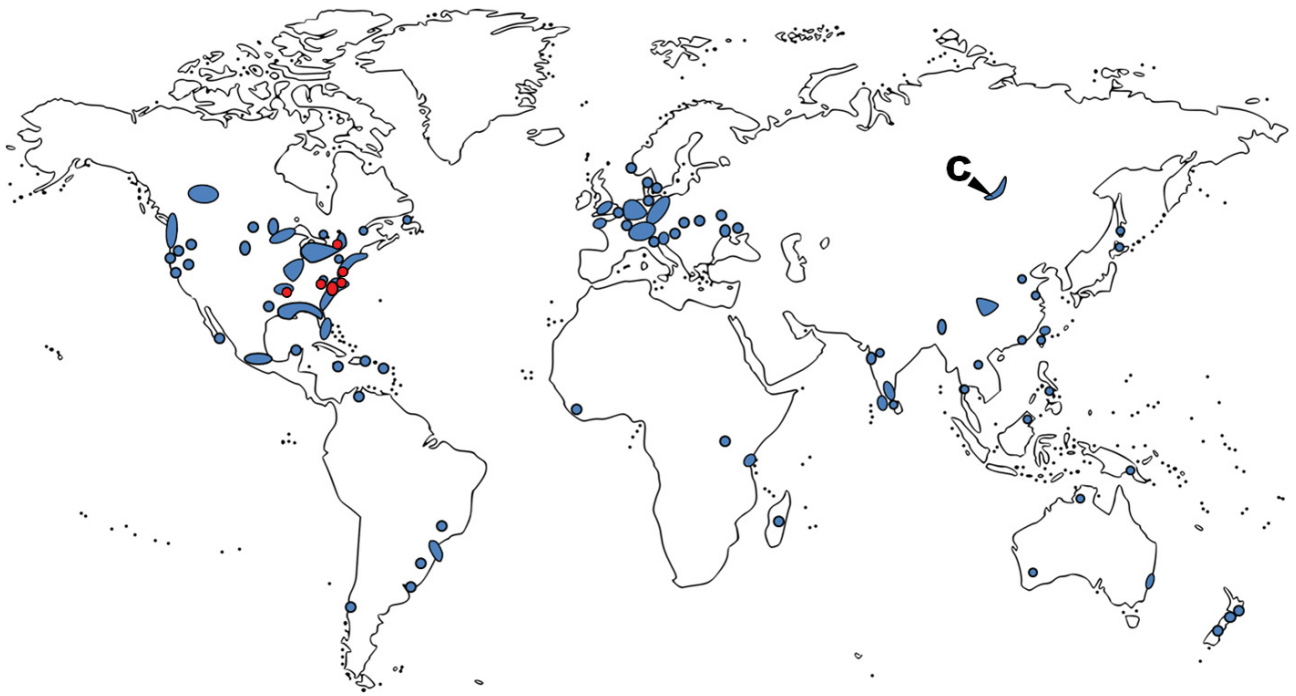
### Biogeography of Lagenophryids

The genus *Lagenophrys* has a truly cosmopolitan distribution, with species having been reported from every continent except Antarctica (Fig. 9). In general, the distributions of individual species mirror those of the hosts. Species that are less specific in their choice of hosts, occurring on different members of a family or genus of crustaceans, have more extensive ranges, especially if they occur in marine or brackish-water habitats. Good examples are *L. eupagurus* Kellicott (occurs on palaemonid shrimp in Europe, Asia, and North America) (Clamp 1989) and *L. cochiniensis* Santhakumari & Gopalan (occurs on wood- and rock-boring sphaerotid isopods in Africa, Asia, New Zealand, North America, and South America) (Clamp 2006). By contrast, the group of species found on amphipods by Swarczewsky (1930) in Lake Baikal is a notable example of endemic species with restricted distributions.

The single species of *Paralagenophrys* has been reported only from scattered localities in the eastern U.S. (Clamp 1987b) (Fig. 9). Owing to its complete lack of substrate-specificity, *P. singularis* might be characterized as 'free-living'; therefore, the fact that it has not been found in Europe suggests that it might have a restricted geographic distribution. All known species of *Setonophrys* appear to be endemic to Australia (Clamp & Kane 2003) (Fig. 10), and *Clistolagenophrys* has been reported only from Lake Baikal (Clamp 1991). Species of *Operculigera* fall into three groups, each of which is endemic to a different part of the southern hemisphere (Australia, Chile, Madagascar) (Fig. 10). This disjunct distribution suggests that *Operculigera* is an extremely old genus, originating before the initial breakup of Gondwana began ~184 Ma ago (Clamp 1992).

### Taxonomic Identification of Lagenophryid Peritrichs

Clamp (1990a) gave a summary and evaluation of morphological features used as taxonomic characters in the genus *Lagenophrys*. For the most part, that information also applies to species in other genera of lagenophryids. As might be expected, accurate identification of lagenophryids to the species level is a 3-step process that begins with determination of the genus, followed by determination of the species, and ending with an evaluation of variation within the sample to confirm that the identification is consistent with information in the literature or not. The first step is relatively easy because each genus of lagenophryids is clearly unique in terms of the closure apparatus of the lorica aperture (Table 1). Within each genus, however, species identification depends on a combination of structural details of the closure apparatus (e.g., sculpturing of the lips of the aperture), shape of the macronucleus, shape and proportions of the lorica, and pattern of ciliary rows in the infundibular polykineties (Fig. 2–8).



**FIGURE 9.** Geographical distributions of known species of *Lagenophrys* (blue), *Paralagenophrys* (red), and *Clistolagenophrys* (arrowhead with 'C').



**FIGURE 10.** Geographical distributions of species of *Setonophrys* (numbers within squares) and *Operculigera* (numbers within circles).

Rather than providing a traditional dichotomous key to species, we have chosen to summarize the geographic distributions and host preferences of lagenophryid species in the form of a matrix in Table 2. Most species are associated with specific crustacean hosts that tend to have restricted geographic distributions; therefore, knowing the locality, type of habitat, and identity of the host allows the identity of lagenophryid symbionts to be narrowed to a small group of species. Using Table 2 in combination with the more detailed information about each species given in the following checklist will make this easier. This should make it possible to generate at least a tentative

identification of any known species of lagenophryid after consulting original descriptions or revisionary papers. For the future, an identification key with links to literature sources, figures, and species descriptions is planned as an on-line, electronic resource that can be updated as needed and adapted to deal with difficulties posed by species complexes, cryptic species, and highly variable species as well as molecular characters or barcoding sequences as these become available.

**TABLE 2.** Matrix showing geographic distributions, general habitat, and hosts of all known species of lagenophryid peritrichs. Species of *Lagenophrys* are categorized into species that are restricted to freshwater versus those that are marine, estuarine, or euryhaline. Members of all other genera are known only from freshwater habitats. Ostracods, copepods, and cladocerans are grouped as “Other hosts.” Lagenophryids occurring in Lake Baikal are presented separately from other Asian species because all but one species are probably endemic to the lake.

		Amphipoda	Isopoda	Decapoda	Other hosts
<i>Lagenophrys</i>					
<i>N. Hemisphere</i>					
Freshwater	Europe	<i>ampulla</i>	<i>aselli</i>		<i>discoidea</i>
		<i>labiata</i>	<i>platei</i> <sup>1</sup>		<i>stammeri</i> <sup>1</sup>
		<i>matthesi</i>	<i>monolistræ</i> <sup>1</sup>		<i>vaginicola</i>
		<i>nassa</i>			
		<i>pontocaspica</i> <sup>1</sup>			
	North America	<i>ampulla</i>	<i>aselli</i>	<i>dennisi</i> <sup>1</sup>	<i>bipartita</i> <sup>1</sup>
		<i>foxi</i> <sup>1</sup>		<i>diogenes</i> <sup>1</sup>	<i>discoidea</i>
		<i>johnsoni</i> <sup>1</sup>		<i>leniusculus</i> <sup>1</sup>	<i>vaginicola</i>
		<i>labiata</i>		<i>metopauliadis</i> <sup>1</sup>	
		<i>lenticula</i>		<i>verecunda</i> <sup>1</sup>	
		<i>matthesi</i>			
		<i>missouriensis</i> <sup>1</sup>			
		<i>nassa</i>			
		<i>patina</i>			
		<i>stygia</i> <sup>1</sup>			
	Asia	<i>ampulla</i>		<i>awerinzewi</i>	<i>discoidea</i>
		<i>hokkaidos</i> <sup>1</sup>		<i>branchiarum</i> <sup>1</sup>	<i>vaginicola</i>
		<i>nassa</i>			
	Lake Baikal	<i>commensalis</i> <sup>1</sup>			
		<i>inflata</i> <sup>1</sup>			
		<i>macrostoma</i> <sup>1</sup>			
		<i>oblonga</i> <sup>1</sup>			
		<i>ornata</i> <sup>1</sup>			
		<i>ovalis</i> <sup>1</sup>			
		<i>parva</i> <sup>1</sup>			
		<i>similis</i> <sup>1</sup>			
		<i>simplex</i> <sup>1</sup>			
	Africa			<i>awerinzewi</i>	
<i>S. Hemisphere</i>					
South America	<i>lenticula</i>		<i>antichthos</i> <sup>1</sup>	<i>discoidea</i>	
	<i>patina</i>		<i>awerinzewi</i>		
			<i>shiftus</i> <sup>1</sup>		

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TABLE 2. (Continued)

		Amphipoda	Isopoda	Decapoda	Other hosts
	Australia/New Guinea			<i>darwinii</i> <sup>1</sup> <i>deserti</i> <sup>1</sup> <i>dungogi</i> <sup>1</sup> <i>engaei</i> <sup>1</sup> <i>jacobi</i> <sup>1</sup> <i>petila</i> <sup>1</sup> <i>rugosa</i> <sup>1</sup> <i>turneri</i> <sup>1</sup> <i>willisi</i> <sup>1</sup>	
	New Zealand			<i>novazealandae</i> <sup>1</sup>	
	Africa			<i>awerinzewi</i> <i>reflexa</i> <sup>1</sup>	
	Madagascar			<i>machaerigera</i> <sup>1</sup>	
					<i>N. Hemisphere</i>
Marine/estuarine/ euryhaline	Europe	<i>maxillaris</i> <sup>1</sup> <i>tattersalli</i> <sup>1</sup>	<i>limnoriae</i>	<i>eupagurus</i>	
	North America	<i>crutchfieldi</i>	<i>cochinensis</i> <i>limnoriae</i>	<i>callinectes</i> <i>eupagurus</i>	
	South America			<i>callinectes</i>	
	Asia	<i>anisogammari</i> <sup>1</sup>	<i>cochinensis</i>	<i>eupagurus</i>	
	Africa		<i>cochinensis</i>		
					<i>S. Hemisphere</i>
	South America	<i>crutchfieldi</i>			
	Africa		<i>cochinensis</i>		
	New Zealand		<i>cochinensis</i>		
<b><i>Paralagenophrys</i></b>					<i>N. Hemisphere</i>
	North America				<i>singularis</i> <sup>1</sup>
<b><i>Clistolagenophrys</i></b>					<i>N. Hemisphere</i>
	Lake Baikal	<i>primitiva</i> <sup>1</sup>			
<b><i>Setonophrys</i></b>					<i>S. Hemisphere</i>
	Australia			<i>bispinosa</i> <sup>1</sup> <i>communis</i> <sup>1</sup> <i>lingulata</i> <sup>1</sup> <i>nivalis</i> <sup>1</sup> <i>occlusa</i> <sup>1</sup> <i>seticola</i> <sup>1</sup> <i>spinosa</i> <sup>1</sup> <i>tricorniculata</i> <sup>1</sup>	
<b><i>Operculigera</i></b>					<i>S. Hemisphere</i>
	Australia		<i>haswelli</i> <sup>1</sup> <i>inornata</i> <sup>1</sup> <i>montanea</i> <sup>1</sup> <i>obstipa</i> <sup>1</sup> <i>zeehanensis</i> <sup>1</sup>		

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TABLE 2. (Continued)

	Amphipoda	Isopoda	Decapoda	Other hosts
South America			<i>asymmetrica</i> <sup>1</sup> <i>insolita</i> <sup>1</sup> <i>parastacis</i> <sup>1</sup> <i>seticola</i> <sup>1</sup> <i>striata</i> <sup>1</sup> <i>taura</i> <sup>1</sup> <i>velata</i> <sup>1</sup>	
Madagascar			<i>carcini</i> <sup>1</sup> <i>madagascarensis</i> <sup>1</sup>	

<sup>1</sup>Possible/probable geographic endemic

### Annotated Checklist of Lagenophryid Species

The following checklist includes all known species in the family Lagenophryidae (Table 2). The checklist is organized by genus, within which species are sorted in descending order by habitat, broad geographic occurrence, host, and restricted geographic occurrence.

Lagenophryidae Bütschli, 1889

#### Lagenophryidae Bütschli, 1889

##### I. *Lagenophrys* Stein, 1852

###### A. Occurring Only In Freshwater

###### 1. Northern Hemisphere

###### a. Restricted to Amphipoda

###### i. Europe only

###### *L. pontocaspica* Boshko, 1995

*Lagenophrys ampulla* Boshko 1992: 32.

**Habitat.** Freshwater, brackish.

**Distribution.** BR: Palaearctic.

Ukraine: Danube basins; Dnieper Basin: Kakhovskoye, Kanevskoye (47°38'26.35"N, 35°5'10.30"E); Dnieper-Bug Lagoon (46°26'36.48"N, 31°59'3.74"E); Dniester (49°2'57.91"N, 24°29'37.95"E); Kiev reservoirs (50°20'30.71"N, 30°36'32.86"E); Nikolayevskaya Oblast (46°58'27.19"N, 31°59'40.12"E); Pokrovka (47°20'43.52"N, 31°31'34.43"E); Stugna River (50°24'48.63"N, 30°34'51.37"E).

**Hosts.** Ukraine: *Amathillina cristata* G. O. Sars, *Chaetogammarus ischnus* (Stebbing), *Dikerogammarus haemobaphes* (Eichwald) (cited as *Dikerogammarus haemobapes*), *D. villosus* (Sowinsky), *Obesogammarus crassus* (G. O. Sars) (cited as *Pontogammarus crassus*), *Pontogammarus abbreviatus* (Sars), *P. maeoticus* (Sowinsky), *P. robustoides* (Sars) (gills and oostegites).

**References.** Boshko 1995, 1996.

###### ii. North America only

###### *L. foxi* Clamp, 1987

**Museum Depositions.** USNM. 40935 Holotype; 40936 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic.

USA: **Illinois**, Monroe Co., 3.2 km N Fountain Gap, spring (38°24'38.36"N 90°14'41.36"W); St. Clair Co., Falling Spring (38°32'10.95"N 90°10'58.43"W). **Missouri**, Lincoln Co., 7.2 km NNW Foley, Hurricane Cr. at MO 79 (39°6'46.45"N 90°45'23.52"W); Jefferson Co., 7.7 km NE Hillsboro, Sandy Cr. at MO 21 (38°17'41.13"N 90°31'44.08"W); Jefferson Co., 4.3 km NNE Hillsboro, creek running parallel with MO 21 at Hayden Rd. (38°16'15.34"N, 90°33'39.83"W).

**Hosts.** USA: *Gammarus minus* Say, *G. pseudolimnaeus* Bousfield, *G. trogophilus* Hubricht & Mackins, *Gammarus* sp. (gills).

**References.** Clamp 1987a; Fernandez-Leborans & Tato-Porto 2000.

***L. johnsoni* Clamp, 1990**

**Museum Depositions.** UNSM. 42301 Holotype; 42302, 42303, 42304, 42304 Paratypes.

**Habitat.** Brackish, freshwater.

**Distribution.** BR: Nearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Canada: **Ontario**, Norfolk Co., Long Point Provincial Park, Long Point Bay alongside ONT 59 (42°34'46.86"N, 80°23'4.30"W). **Quebec**, L'Islet Co., St. Jean-Port-Joli, mouth of Tortue R. at QUE 2 (47°08'56"N, 70°20'21"W).

USA: **Michigan**, Delta Co. 4 km E Isabella, Little Fshdam R. at U.S. 2 (43°35'13.81"N, 84°48'30.24"W). **New Jersey**, Monmouth Co., Brielle, Silver Fox Forge Pond (74°40'6'36.14"N, 74°2'38.51"W). **New York**, Cayuga Co., 3.2 km E Meridian, creek at NY 370 (43°9'50.44"N, 76°28'41.04"W); Oswego Co., 1.6 km S Minetto, Oswego R. alongside NY 48 (43°23'16.69"N, 76°27'46.93"W); Oswego Co., 8.5 km WSW Sandy Creek center, Sandy Pond (North Pond) at Ouderkirk Rd. (43°37'54.58"N, 76°11'17.70"W); Oswego Co., 4.5 km SSW West Monroe, Oneida Lake at Shaw's Point (43°14'42.92"N, 76°5'34.37"W). **North Carolina**, Brunswick Co., 5.3 km S Supply, creek at Secondary Road 1115, 0.6 km from jct. Secondary Road 1125 (33°58'7.78"N, 78°15'35.41"W); Dare Co., Bodie Island, 8.8 km SSE Nag's Head, creek at NC 12, 2.6 km S jct. U.S. 64 with U.S. 264 (35°49'9.58"N, 75°33'19.33"W); Dare Co., 8 km NNW Mann's Harbor, creek near Mashoes (35°57'48.18"N, 75°49'24.53"W); Hyde Co., 7.4 km S Fairfield, Lake Mattamuskeet alongside NC 94 causeway (35°28'10.32"N, 76°12'47.43"W); Tyrrell Co., 5.9 km NW Columbia, Scuppernong R. at River Neck (35°57'39.92"N, 76°12'33.77"W); Tyrrell Co., 4.8 km NW Travis, Bull Bay at end Secondary Road 1202 (35°55'43.07"N, 76°22'9.50"W); Tyrrell Co., Gum Neck Landing, boating access area at end Secondary Road 1316 (35°41'34.81"N, 76°6'49.78"W); Tyrrell Co., Fort Landing, Alligator Creek at end Secondary Road 1209 (35°58'44.70"N, 76°14'26.30"W); Washington Co., Albemarle Beach, Albemarle Sound at end Secondary Road 1323 (35°57'53.94"N, 76°27'42.30"W).

**Hosts.** Canada: *Gammarus fasciatus* Say (gills). USA: *Gammarus daiberi* Bousfield, *G. fasciatus*, *G. tigrinus* Sexton (gills).

**References.** Clamp 1990b; Fernandez-Leborans & Tato-Porto 2000.

***L. missouriensis* Clamp, 1987**

**Museum Depositions.** USNM. 40937 Holotype; 40938 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic.

USA: **Michigan**, Kent Co., 11.2 km ENE Evans, tributary of Flat R. at Lincoln Lake Rd., 6.7 km N jct. MI 57. **Missouri**, Jefferson Co., 4.3 km NNE Hillsboro, creek running parallel to MO 21 at Hayden Rd. (38°16'15.81"N, 90°33'40.88"W); Lincoln Co., 7.2 km NNW Foley, Hurricane Cr. at MO 79 (39°06'27.85"N, 90°46'14.11"W). **Wisconsin**, Bayfield Co., 3.2 km S Barksdale, stream at WIS 13 near jct. US 2 (46°35' 41.82"N, 90°57'17.91"W); Bayfield Co., 6.4 km N; Washburn, Sioux Creek Slough at WIS 13 (46°43'55.85"N, 90°52'42.58"W).

**Hosts.** USA: *Gammarus pseudolimnaeus* (surfaces of peraeon and pleon).

**References.** Clamp 1987a; Fernandez-Leborans 2009.

***L. stygia* Clamp, 1990**

*Lagenophrys labiata* Jakschik 1967a: 24.

*Circolagenophrys stygia* Jankowski 1993: 221.

**Museum Depositions.** USNM. 42306 Holotype; 42307, 42308 Paratypes.

**Habitat.** Subterranean.

**Distribution.** BR: Nearctic.

USA: **Illinois**, Champaign Co. 1 mi. S Sellers, drainage tile (40°10'14.77"N, 88°6'13.33"W); Christian Co., 4.0 mi. E Taylorville, Spring Cr. (39°33'7.43"N, 88°34'19.65"W); Vermilion Co., 1.5 mi. N Fithian, tributary of Stony Cr. (40° 7'51.57"N, 87°52'22.73"W).

**Hosts.** USA: *Bactrurus mucronatus* (Forbes) (gills).

**References.** Clamp 1984, 1990a; Fernandez-Leborans & Tato-Porto 2000.

**iii. Asia only**

***L. hokkaidos* (Jankowski, 1993)**

*Circolagenophrys hokkaidos* Jankowski 1993: 222.

*Lagenophrys ampulla* Imamura 1940: 267, 268.

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Japan: Hokkaido, near Sapporo; Chitose, fish farm pond (42°48'11.90"N, 141°41'13.62"E).

**Hosts.** Japan: *Jesogammarus* (*Annanogammarus*) *annandalei* (Tattersall) (cited as *Gammarus annandalei*) (gills and maxillipeds).

**References.** Imamura 1940; Jankowski 1993.

#### iv. Lake Baikal endemics

##### *L. commensalis* Swarczewsky, 1930

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Bolschye Koty im Bezirk Biological Station (51°53'52.12"N, 105°4'22.60"E); Irkutsk (52°16'30.18"N, 104°18'12.29"E).

**Hosts.** Russia: Lake Baikal: *Carinurus solsky* (Dybowsky, 1874) (maxillipeds).

**References.** Swarczewsky 1930; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

##### *L. inflata* Swarczewsky, 1930

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Bolschye Koty im Bezirk Biological Station (51°53'52.12"N, 105°4'22.60"E); Bolschye Koty (51°53'52.12"N, 105°4'22.60"E); Irkutsk (52°16'30.18"N, 104°18'12.29"E).

**Hosts.** Russia: *Gmelinoides fasciatus* (cited as *Brandtia fasciata*) (pleopods).

**References.** Swarczewsky 1930; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

##### *L. macrostoma* Swarczewsky, 1930

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk (52°16'30.18"N, 104°18'12.29"E); Bolschye Koty (51°53'52.12"N, 105°4'22.60"E); Listwenitschnoje.

**Hosts.** Russia: *Coniurus radoschkowskii* (Dybowsky) (gills).

**References.** Swarczewsky 1930; Fernandez-Leborans & Tato-Porto 2000.

##### *L. oblonga* Swarczewsky, 1930

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk, Bolschye Koty (51°53'52.12"N, 105°4'22.60"E).

**Hosts.** Russia: *Eulimnogammarus hyacinthus* (Dybowsky) (cited as *Gammarus hyacinthinus*) (first pair of antennae).

**References.** Swarczewsky 1930; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

##### *L. ornata* Swarczewsky, 1930

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk, Bolschye Koty (51°53'52.12"N, 105°4'22.60"E).

**Hosts.** Russia: *Eulimnogammarus cyanoides* (cited as *Echinogammarus cyanoides*), *Carinogammarus rhodophthalmus sablotzkii* (cited as *Carinogammarus sablotzky*) (pereopods).

**References.** Swarczewsky 1930; Fernandez-Leborans & Tato-Porto 2000.

##### *L. ovalis* Swarczewsky, 1930

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk, Bolschye Koty (51°53'52.12"N, 105°4'22.60"E).

**Hosts.** Russia: *Hyaellopsis variabilis* (pereopods), *Micruropus littoralis crassipes*, *M. talitroides* (pereopods), *Macropereiopus wagneri* Sowinsky (pereopods), *Eulimnogammarus cyanoides* (also cited as *Echinogammarus cyanoides*) (pereopods).

**References.** Swarczewsky 1930; Fernandez-Leborans & Tato-Porto 2000.



***L. parva* Swarczewsky, 1930**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk, Bolschye Koty (51°53'52.12"N, 105°4'22.60"E); Uschkan Islands (53°49'51.47"N, 108°37'3.15"E); Tschiwyrkui Gulf.

**Hosts.** Russia: *Crypturopus pachytus* (pereiopods), *Eulimnogammarus fuscus* (cited as *Echinogammarus fuscus*) (pereiopods).

**References.** Swarczewsky 1930; Fernandez-Leborans & Tato-Porto 2000.

***L. similis* Swarczewsky, 1930**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk, Bolschije Koty (51°53'52.12"N, 105°4'22.60"E); Rayon, Biological Station.

**Hosts.** Russia: *Eulimnogammarus verrucosus* (cited as *Echinogammarus verrucosus*), *Hyalellopsis czernianskii* (cited as *Hyalellopsis czernianski*) (gills).

**References.** Swarczewsky 1930; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

***L. simplex* Swarczewsky, 1930**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk, Uschkanji Islands (53°49'51.47"N, 108°37'3.15"E); Olchonskije Worota.

**Hosts.** Russia: *Dorogammarus castaneus* (cited as *Axelboeckia castanea*), *Pallasea (Propachygammarus) bicornis* Dorogostajsky (cited as *Pallasea bicornis*) (pereiopods).

**References.** Swarczewsky 1930; Fernandez-Leborans & Tato-Porto 2000.

***L. solida* Swarczewsky, 1930**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk (52°16'30.18"N, 104°18'12.29"E); Golf Tschiwyrkui.

**Hosts.** Russia: *Plesiogammarus (Plesiogammarus) gerstaeckeri* (Dybowsky) (cited as *Plesiogammarus gersteckeri*) (pereiopods).

**References.** Swarczewsky 1930; Fernandez-Leborans & Tato-Porto 2000.

***L. stokesi* Swarczewsky, 1930**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk (52°16'30.18"N, 104°18'12.29"E); Smorodowaja; Bolschye Koty (51°53'52.12"N, 105°4'22.60"E); Tschiwyrkui Gulf; Bargusin Gulf (53°25'7.51"N, 109°1'14.76"E); mouth of Sselenga R; Kultuk (51°42'12.50"N, 103°42'11.71"E).

**Hosts.** Russia: *Axelboeckia potanini* (gills), *Odontogammarus calcaratus*, *Ommatogammarus (Abludogammarus) flavus* (cited as *Ommatogammarus flavus*), *Ommatogammarus (Pretiositus) carneolus* (Dybowsky) (cited as *Ommatogammarus carneolus*).

**References.** Swarczewsky 1930; Fernandez-Leborans & Tato-Porto 2000.

**v. Broad Distribution**

***L. ampulla* Stein, 1852**

*Circolagenophrys ampulla* Walker *et al.* 1986: 246-255.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Canada: **Alberta**, 5 mi. W Canyon Creek, creek at ALTA 2 (55°23'34.10"N, 116°1'49.34"W); 2 mi. E. Vilna, Cache L. at ALTA 28 (54°7'51.77"N, 111°50'59.44"W).

France: **Bretagne**, Cotes du Nord, 0.75 mi. SE Louargat, creek at D31 (48°33'26.02"N, 3°19'54.53"W); Cotes du Nord, 1.1 mi NW Louargat creek at D31 (48°34'54.59"N, 3°20'47.08"W); 2.2 mi WNW Belle-Isle-en-Terre, creek at N12 (48°32'55.04"N, 3°26'56.39"W); Finisterre Nord, 1.75 mi NNW Cleder, creek near Kersaint (48°41'3.27"N, 4°7'18.63"W).

Germany: **Bavaria**, near Erlangen; near Munich (47°8'47.74"N, 10°56'3.82"E); Bielefeld. **Saxony**, Dresden, near Tharandt, small rocky brooks (50°59'24.35"N, 13°35'6.99"E). **Wurttemberg**, near Freiburg-im-Breisgau.

Netherlands: **Gelderland**, 1.1 mi SW Uddel, Hierdensche R. (52°14'48.56"N, 5°45'46.15"E).

Russia: **Lake Baikal** (53°3'10.70"N, 108°17'31.36"E); Anga; Barantschik Irkutsk, Golf Smorodowaja; Bolschye Koty (51°54'12.97"N, 105°4'49.79"E); Golf Bargusin (53°36'58.41"N, 109°8'2.64"E); Golf Pestschannaja; Golf Tschiwirkuj; Goloustnoje (52°1'35.29"N, 105°24'15.08"E); Kultuk (51°43'2.24"N, 103°42'31.34"E); Kleines Meer; Listwjenitschnoje; Oblom (52°26'34.42"N, 106°53'26.49"E); Olchonskije Worota; Shilischtsche. **Siberia** (53°3'10.70"N, 108°17'31.36"E); Usckkanji-Inseln.

Switzerland: **Basel**, near Basel, Allschwil (47°32'40.97"N, 7°32'11.26"E); near Basel, Schusterinsel. **Geneve**, near Geneva (46°11'38.00"N, 6°8'20.95"E); Aire, Rhone R. (46°9'7.17"N, 6°4'33.70"E). **Coppet**, Lac Leman (littoral zone) (46°18'58.58"N, 6°11'36.82"E). **Vaud**, near Ste. Croix (south of the city), Tourbieres de la Sagne (peat bog) (46°48'32.78"N, 6°30'20.16"E).

UK: **Leicester**, stream near Leicester University (52°37'21.52"N, 1°8'36.34"W).

USA: **Minnesota**, Clearwater Co. Lake Itasca State Park, L. Itasca (47°12'52.16''N, 95°12'25.51''W); Kandiyohi Co. 2 mi. E. Spicer, Woodcock L. (45°14'15.75''N, 94°57'0.04''W).

**Hosts.** Canada: *Gammarus lacustris lacustris* Sars (gills), *Crangonyx* sp. (gills). France: *Echinogammarus berilloni* (Catta) (gills), *Gammarus duebeni* Liljeborg (gills), *G. pulex* var. *pulex* (Linnaeus) (cited as *Gammarus pulex pulex*) (gills). Germany: *Gammarus pulex* Linnaeus (gills), *Gammarus* sp. (gills). Netherlands: *Gammarus pulex* var. *pulex* (cited as *Gammarus pulex pulex*) (gills). Russia: (in all cases found on the gills): *Acanthogammarus (Ancyracanthus) victorii* Dybowski, *Acanthogammarus (Acanthogammarus) albus* (Garjajeff) (cited as *Acanthogammarus albus*), *Acanthogammarus (Acanthogammarus) godlewskii* (Dybowsky) (cited as *Acanthogammarus godlewsky*), *Axelboeckia carpenteri* (Dybowsky), *A. potanini* (Dorogostaisky), *Brandtia latissima* (Gerstfeldt), *B. latissima lata* (Dybowsky) (cited as *Brandtia lata*), *Carinogammarus cinammomeus* (Dybowsky), *C. rhodophthalmus rhodophthalmus* (Dybowsky), *C. rhodophthalmus sablotzkii* (Sowinsky), *Crypturopus inflatus* (Dybowsky), *C. pachytus* (Dybowsky), *C. rugosus* (Dybowsky) (cited as *Crypturopus rugosa*), *C. tuberculatus* (Dybowsky), *Diplacanthus brevispinus* (Dorogostaisky) (cited as *Acanthogammarus brevispinus*), *Dorogammarus castaneus* (Dorogostaisky) (cited as *Axelboeckia castanea*), *Echiuropus macronychus* Sowinsky, *E. morawitzi* (Dybowsky), *Eucarinogammarus wagii* (Dybowsky) (cited as *Eucarinogammarus wagi*), *Eulimnogammarus aheneus* (Dybowsky) (cited as *Echinogammarus ahaeneus*), *E. capreolus* (Dybowsky), *E. cruentus* (Dorogostaisky) (cited as *Echinogammarus cruentus*), *E. cyaneus* (Dybowsky) (cited as *Echinogammarus cyaneus*), *E. cyanoides* (Sowinsky) (cited as *Echinogammarus cyanoides*), *E. fuscus* (Dybowsky) (cited as *Echinogammarus fuscus*), *E. lividus* (Dybowsky) (cited as *Echinogammarus lividus*), *E. maackii* (Gerstfeldt) (cited as *Echinogammarus lividus maaki*), *E. olivaceus* (Dybowsky) (cited as *Echinogammarus olivaceus*), *E. sophianosi* (Dybowsky), *E. verrucosus* (Gerstfeldt) (cited as *Echinogammarus verrucosus*), *E. viridis* (Dybowsky) (cited as *Eulimnogammarus viridis viridis*), *Garjajewia cabanisii* (Dybowsky) (cited as *Garjajewia cabanisi*), *Gmelinoides fasciatus* Stebbing (cited as *Brandtia fasciata*), *Heterogammarus sophianosii* (Dybowsky) (cited as *Heterogammarus sofianosi*), *Hyaallelopsis czarnianskii* (Dybowsky) (cited as *Hyaallelopsis czarniansky*), *H. variabilis* Dorogostaisky, *Micruropus fixsenii* (Dybowsky) (cited as *Micruropus fixeni*), *M. glaber* (Dybowsky), *M. klukii* (Dybowsky) (cited as *Micruropus kluki*), *M. littoralis crassipes* Sowinsky, *M. rugosus*, *M. talitroides* (Dybowsky), *M. wahlII* (Dybowsky) (cited as *M. wahlI*), *Micruropus (Microgammarus) vortex* (Dybowsky) (cited as *Micruropus vortex*), *Odontogammarus calcaratus* (Dybowsky), *O. margaritaceus demianowiczi* Dorogostaisky (cited as *O. demjanowiczi*), *Ommatogammarus (Abludogammarus) flavus* (Dybowsky) (cited as *Ommatogammarus flavus*), *Pallasea cancellus* (Pallas), *P. cancelloides* (Gerst.), *P. grubei* (Dybowsky), *P. kessleri* (Dybowsky), *Parapallasea puzylli* (Dybowsky). Switzerland: *Gammarus pulex*, *Gammarus* sp. (gills). UK: *Gammarus pulex* (gills). USA: *Gammarus lacustris lacustris* (gills).

**References.** Swarczewsky 1930; Clamp 1984; Walker *et al.* 1986; Rustige 1991; Rustige & Mannesmann 1991.

#### ***L. labiata* Stokes, 1887**

*Lagenophrys labiata* Stokes 1887: 40; Stokes 1888: 262-263; von Ubisch 1913: 43; Keiser 1921: 286; Abonyi 1928: 9, 18; Swarczewsky 1930: 458; Kahl 1935: 796.

**Museum Depositions.** USNM. 42316, 42317 Neotypes; 42318, 42319, 42320.

**Habitat.** Freshwater, brackish.

**Distribution.** BR: Nearctic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Poland: Streams in the vicinity of Poznan.

USA: **Michigan**, Ottawa Co., 8.0 km S Grandhaven, slough at Lakeshore Drive (42°59'30.04"N, 86°13'11.53"W); Ottawa Co., 3.8 km W West Olive, mouth of Pigeon R. (42°54'3.64"N, 86°11'1.43"W). **New Jersey**, Mercer Co., near Trenton (40°12'17.84"N, 74°46'1.66"W); Monmouth Co., Brielle, Silver Fox Forge Pond (40°6'15.34"N, 74°3'4.31"W). **New York**, Cayuga Co., Fair Haven Beach State Park, The Pond (43°20'2.55"N, 76°41'31.16"W); Oswego Co., 8.5 km WSW Sandy Creek center, Sandy Pond (North Pond) at Ouderkirk Rd. (43°37'54.58"N, 76°11'17.70"W); Oswego Co., 4.5 km SSW West Monroe, Oneida Lake at Shaw's Point (43°14'42.92"N, 76°5'34.37"W). **North Carolina**, Tyrrell Co., 5.9 km NW Columbia, Scuppernong R. at River Neck (35°57'31.10"N, 76°17'27.75"W); Tyrrell Co., Alligator Cr. at Fort Landing (35°54'52.06"N, 76°1'28.32"W); Washington Co., Albemarle Beach, Albemarle Sound at end SR 1323 (35°56'10.74"N, 76°38'27.99"W).

**Hosts.** Poznan: *Gammarus fossarum* Koch. USA: *Crangonyx gracilis* S. I. Smith, *Gammarus daiberi* Bousfield, *Gammarus fasciatus* Say, *Gammarus tigrinus*, *Gammarus* sp. (surface of carapace and appendages and body).

References. Piezik 1975; Clamp 1990a; Fernandez-Leborans & Tato-Porto 2000.

***L. lenticula* (Kellicott, 1885)**

*Stylohedra lenticula* Kellicott 1885: 122; Stokes 1888: 262.

*Stylohedra lenticulata* Kahl 1935: 799.

*Lagenophrys lenticulata* Thomsen 1945: 1-9.

**Museum Depositions.** USNM. 42123 Neotype; 42124.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic, Neotropical (Mayén-Estrada & Aguilar-Aguilar 2012).

Canada: **Alberta**, 16 km S Little Smoky, creek at ALTA 43 (54°35'24.39"N, 117°2'37.75"W); 74.8 km S Valleyview, creek at ALTA 43 (54°25'58.87"N, 116°55'5.31"W); 32 km W High Prairie, creek at ALTA 2 (55°38'11.19"N, 116°51'6.22"W); 3.2 km E Vilna, Cache Lake at ALTA 28 (54°6'39.27"N, 111°58'8.06"W). **Newfoundland**, near Norris Point, pond alongside NFLD 73, 4.8 km N jct. NFLD 44 (49°31'41.53"N, 57°52'54.88"W). **Ontario**, Carleton Co., Rideau River, S Ottawa (45°3'12.10"N, 75°39'17.58"W); Middlesex Co., Thamesford, creek at ONT 19 just S town limit (43°3'19.52"N, 80°59'27.78"W); Norfolk Co., 2.6 mi. S Port Rowan, Long Point, marsh alongside ONT 59 (42°35'12.54"N, 80°26'32.39"W); Norfolk Co., Long Point Provincial Park, Long Point Bay at ONT 59 (42°35'2.07"N, 80°23'15.54"W); Sudbury Co., 6.4 km W Whitefish, ditch alongside ONT 17 (46°21'58.52"N, 81°24'7.2"W); Sudbury Co., 4.8 km W Naughton, small lake alongside ONT 17 (46°23'34.56"N, 81°15'30.39"W); Welland Co., Wainfleet, canal at ONT 3 (42°55'28.6"N, 79°22'35.08"W). **Quebec**, Gatineau Co., Gatineau National Park, Taylor Lake (45°36'12.58"N, 76°02'57.38"W).

Mexico: **Michoacán**, Cuitzeo lake, San Cristóbal (19°57'41"N, 101°18'55"W)\*\* present work; Pátzcuaro lake (19°32' to 19°41'N, 101°32' to 101°43'W). **Puebla**, creek near city of Puebla; La Preciosa lake (19°13' to 19°24'N, 97°17' to 97°29'W)\*\*present work; Tecocomulco lake (19°42'13.7" to 19°59'30"N, 98°11'46.2" to 98°27'30"W).

Uruguay: near Montevideo, pond at Sayago (34°47'37.52"N, 56°11'12.7"W); Near Montevideo, small temporary ponds (34°55'35.91"N, 56°09'17.27"W).

USA: **Indiana**, Whitley Co., 4.8 km WNW Churubusco, Blue Lake (41°14'26.45"N, 85°22'19.29"W). **Michigan**, Barry Co., 8.0 km SW Hastings, Leach Lake (42°40'52.07"N, 85°17'22.77"W); Muskegon Co., Whitehall, White River (43°15'46.07"N, 86°6'6.91"W); Oakland Co., 7.2 km SW Pontiac, ditch running into Pine Lake at N shore of lake (42°35'21.1"N, 83°21'10.61"W); Ottawa Co., 8.0 km S Grandhaven, slough at Lakeshore Dr. (42°59'24.47"N, 86°13'12.38"W); Ottawa Co., 3.8 km W West Olive, mouth of Pigeon River; Shiawassee Co., Corunna, Shiawassee River, above dam (43°19'16.92"N, 84°05'21.96"W); near Owosso, Mud Lake (42°48'14.41"N, 83°54'13.94"W). **Minnesota**, Clearwater Co., Lake Itasca State Park, Lake Itasca (47°12'52.16"N, 95°12'25.51"W); Kandiyohi Co., 3.2 km E Spicer, Woodcock Lake (45°14'15.75"N, 94°57'0.04"W); Pine Co., 2 mi. E Hinckley, Grindstone River at MN 48 (46°00'39.4"N, 92°53'14.34"W); Stearns Co., 1.6 km W Richmond, stream at MINN 23 near jct. Co. Rd. 43 (45°26'55.02"N, 94°32'14.95"W).

**Hosts.** Canada: *Hyaella azteca* (Saussure) (setae pereopods). Mexico: *Hyaella azteca* (setae pereopods, antennae, pleopods, uropods and telson), *Hyaella* sp. (corporal surface). Uruguay: *Hyaella curvispina* Shoemaker

(setae pereopods). USA: *Crangonyx gracilis*, *Gammarus lacustris* Sars (setae pereopods), *Gammarus pulex* (legs), *Hyaella azteca* (setae pereopods).

**References.** Clamp 1991; Fernandez-Leborans & Tato-Porto 2000; Aladro-Lubel & Sánchez-Calderón 2005; Aladro-Lubel *et al.* 2006; Mayén-Estrada & Aladro-Lubel 2006; \*\*Present work.

***L. matthesi* Schödel, 1983**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

France: **Pas de Calais**, Ambleteuse, Riviere la Slack (50°48'18.20''N, 1°36'13.69''E).

Germany: **Bielefeld** (no locality given).

**Hosts.** France: *Gammarus zaddachi* Sexton (cited as *Gammarus zadacchi*) (maxillipeds). Germany: *Gammarus pulex*, *G. roeselii* Gervais (cited as *Carinogammarus roeselii*) (maxillipeds and gnathopods).

**References.** Schödel 1983; Rustige 1991; Clamp 2005.

***L. nassa* Stein, 1852**

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Canada: **Alberta**, 2 mi. E Vilna, Cache L. at ALTA 28 (54°8'27.85"N, 111°46'51.82"W).

France: **Bretagne**, Côtes-du-Nord, 0.75 mi. SE Louargat, creek at D31 (48°33'23.89"N, 3°19'53.41"W); Côtes-du-Nord, 1.1 mi. NW Louargat, creek at D31 (48°34'54.54"N, 3°20'47.71"W).

Germany: **Bavaria**, near Freiburg-im-Breisgau (47°58'56.13"N, 7°51'23.17"E); Bielefeld; Near Erlangen spring near Vach (49°31'16.43"N, 10°58'3.92"E); Potsdam, Niemegk (52°4'45.00"N, 12°41'46.94"E).

Italy: **Lombardy**, near Ponte Tresa, Lago di Lugano (45°58'7.82"N, 8°51'38.12"E); near Porto Ceresio, Lago di Lugano (45°54'22.16"N, 8°54'21.23"E).

Russia: **Lake Baikal**, Irkutsk (51°53'52.12"N, 105°4'22.60"E).

Switzerland: **Basel**, near Basel, Allschwil (47°33'17.42"N, 7°32'43.67"E); near Basel, Schusterinsel (47°35'32.64"N, 7°35'30.86"E). **Geneve**, near Geneva, small stream at Troinex (46°9'41.88"N, 6°8'48.97"E).

USA: **Minnesota**, Clearwater Co., Lake Itasca State Park, L Itasca (47°13'3.33"N, 95°12'6.54"W). **Washington**, Island Co. Whidbey Island, 1 mi. E Keystone, ditch alongside WA 113 (48°9'48.94"N, 122°36'25.46"W).

**Hosts.** Canada: *Gammarus lacustris lacustris* Sars (coxae and pereopods). France: *Echinogammarus berilloni* (coxae and pereopods). Germany: *Gammarus pulex* (coxae, pereopods, corporal surfaces), *G. roeselii* (cited as *Carinogammarus roeselii*) (pereopods). Italy: *Gammarus* sp. Russia: gammarid amphipods (appendages and carapace). Switzerland: *Gammarus pulex* (pereopods and abdomen). USA: *Gammarus lacustris lacustris* (pereopods), *Eogammarus confervicolus* (Stimpson) (coxae and pereopods).

**References.** Clamp 1984; Rustige 1991; Rustige & Mannesmann 1991.

***L. patina* Stokes, 1887**

*Lagenophrys patina* Stokes 1887: 252; Stokes 1888: 260; Kahl 1935: 797; Kane 1965: 121.

*Lagenophrys labiata* Shomay 1954a: 2; Shomay 1954b: 9; Corliss & Brough 1965: 73, 78; Clamp 1973: 561; Felgenhauer 1979: 591-595 (reported from *Hyaella azteca*).

**Museum Depositions.** USNM. 42701 Neotype; 42321, 42322, 42323, 42324, 42325, 42326, 42327.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic, Neotropical (Mayén-Estrada & Aguilar-Aguilar 2012).

Canada: **Alberta**, 10 Mi. S Little Smoky, creek at ALTA 43 (54°35'42.73"N, 117°2'48.91"W); 20 mi. W High Prairie, creek at ALTA 2 (55°38'14.10"N, 116°51'4.17"W); 5 mi. W Canyon Creek, creek at ALTA 2 (55°20'43.76"N 115°11'47.28"W); 2 mi. E Vilna, Cache L. at ALTA 28 (54°8'27.85"N, 111°46'51.82"W); Faust, shallows of Lesser Slave L. (55°19'22.62"N, 115°38'16.67"W). **Newfoundland**, near Porris Point, pond alongside NFLD 73, 3 mi. N jct. NFLD 44. **Ontario**, Carleton Co. Rideau R. S. Ottawa (45°25'32.48"N, 75°40'13.65"W); Middlesex Co., Thamesford, creek at ONT 19, just S town limit (43°3'20.23"N, 80°59'25.92"W); Norfolk Co., 2.6 mi. S Port Rowan, marsh alongside ONT 59 at head of long Point (42°35'8.78"N, 80°26'58.79"W); Norfolk Co., Long Point Provincial Park, Long Point Bay alongside ONT 59 (42°34'40.34"N, 80°26'19.32"W); Sudbury Co., 4 mi. W Whitefish, ditch alongside ONT 17 (46°22'1.29"N, 81°23'56.15"W); Sudbury Co., 3 mi. W Naughton, lake alongside ONT 17 (46°23'35.36"N, 81°15'21.96"W); Welland Co., Wainfleet, canal at ONT 3 (42°55'21.97"N,



79°22'45.05"W). **Quebec**, Gatineau Co., Gatineau National Park, Taylor L. (45°30'22.15"N, 75°48'46.42"W).

Mexico: **Michoacán**, Cuitzeo lake, San Cristóbal (19°57'41"N, 101°18'55"W)\*\*present work; Pátzcuaro lake (19°32' to 19°41'N, 101°32' to 101°43'W). **Puebla**, creek near city of Puebla; Alchichica lake (19°24'13"N, 97°24'00"W)\*\*present work; Atexcac lake (19°13'21"N, 97°27'19"W)\*\*present work; La Preciosa lake (19°13' to 19°24'N, 97°17' to 97°29'W)\*\*present work.

Uruguay: Near Montevideo, pond at Sayoga and temporary ponds (34°51'0.70"S, 56°15'0.36"W).

USA: **Arkansas**, Lee Co., 2.9 mi. NE Brickey's tributary to Frenchman's Bayou at US 79 (34°54'17.78"N, 90°31'48.09"W); Montgomery Co., 4.0 mi. E Mt. Ida, Shady creek at US 270 (34°33'59.11"N, 93°38'58.52"W). **Delaware**, Kent Co., Milford, Haven L. (38°54'47.88"N, 75°26'52.41"W); Kent Co., 1.7 mi. N Cheswold, Garrison's L. (39°14'39.94"N, 75°35'39.04"W); Kent Co., Smyrna, L. Como (39°17'27.75"N, 75°36'16.02"W). **Florida**, Bay, Co., Mexico Beach, creek at US 98, 0.4 mi. SE jct. FLA 386A (29°55'6.95"N, 85°22'47.60"W); Leon, Co., near Tallahassee, L. Jackson (30°30'22.18"N, 84°18'33.02"W). **Georgia**, McIntosh Co., Sapelo Island, ornamental pond on grounds of University of Georgia Marine Institute (31°23'49.37"N, 81°16'51.22"W). **Illinois**, Coles Co., 2.5 mi. SE Charleston, L. Charleston (39°28'13.40"N, 88°8'58.07"W); Vermilion Co., just E Muncie, pond south of US 150 (40°6'47.64"N, 87°50'19.31"W). **Indiana**, Whitley Co., 3.0 mi. WNW Churubusco, Blue L. (41°14'39.03"N, 85°22'29.48"W). **Louisiana**, Orleans Pa., 1.8 mi. SSW Green's Ditch, oxbow of Bayou LeSaire alongside US 90 (30°5'23.69"N, 89°46'38.22"W); Vermilion Pa., 12.5 mi. SW Abbeville, ditch alongside LA 333, 4.0 mi. jct. LA 82 (29°47'12.72"N, 92°12'29.20"W). **Michigan**, Barry Co., 5.0 mi. SW Hastings (42°35'31.60"N, 85°21'24.23"W); Leach L. at boating access (42°41'1.79"N, 85°17'21.90"W); Muskegon Co., Whitehall, White R. at city park (43°24'42.65"N, 86°19'59.96"W); Ottawa Co., 5.0 mi. S Grandhaven slough at Lakeshore Dr. (42°59'26.13"N, 86°13'35.60"W); Ottawa Co., 2.4 mi. W West Olive, mouth of Pigeon R. (42°54'13.30"N, 86°10'56.36"W); Oakland Co., 4.5 mi. SW Pontiac, ditch at N shore Pine L. (42°35'32.0"N, 83°20'36.38"W); Shiawassee Co., Corunna Shiawassee R. above dam (42°55'45.79"N, 84°4'20.21"W). **Minnesota**, Clearwater Co., Lake Itasca State Park, L. Itasca (47°13'3.33"N, 95°12'6.54"W); Clearwater Co., Lake Itasca State Park, L. Itasca, headwaters of Mississippi R. (47°13'3.33"N, 95°12'6.54"W); Clearwater Co., Red Lake Indian Reservation, Lower Red L., 1 mi. N Red Lake R. (47°52'53.02"N, 95°0'0.89"W); Clearwater Co., Red Lake Indian Reservation, mouth of Sandy R. (47°52'29.16"N, 95°12'35.04"W); Kandiyohi Co., 2 mi. E Spicer, Woodchuck L. (45°13'56.00"N, 94°53'56.98"W); Pennington Co., 1 mi. E S. Hilaire, Thief R. at Co. Rd. 31 (43°53'28.81"N, 103°28'53.87"W); Pine Co., 2 mi. E Hinckley, Grindstone R. at MINN 48 (46°0'39.23"N, 92°53'13.82"W); Stearns Co., 1.0 mi. W Richmond stream at MINN 23, near jct Co. Rd. 43 (45°26'37.55"N, 94°33'22.02"W). **Nebraska**, Dawes Co., 26 mi. S Chadron, Niobrara R. below dam at Box Butte Reservoir (42°27'7.90"N, 102°58'12.67"W); Morrill Co., 3mi. N Bridgeport, stream at US 385 (41°13'40.81"N, 73°11'50.98"W). **New Jersey**, Atlantic Co., Hammonton, Hammonton L. (39°37'47.23"N, 74°46'41.10"W); Mercer Co., near Trenton (40°12'17.84"N, 74°46'1.66"W). **New York**, Cayuga Co., Fair Haven Beach State Park, The Pond (43°19'46.23"N, 76°41'44.95"W); Genesee Co., 3.5 mi. NW Alabama, marsh alongside Meadeville Rd. on Tonawanda Game Area 0.5 mi. S jct. Co. Rd. 12 (43°7'3.94"N, 78°27'23.79"W); Oswego Co., 5.3 mi. WSW Sandy Creek center, Sand Pond (North Pond) at Ouderkik Rd. (43°37'57.55"N, 76°11'24.59"W); Oswego Co., 1.7 mi. N New Haven, Catfish Cr. at Co. Rd. (43°30'7.52"N, 76°18'58.67"W). **North Carolina**, Bertie Co., 1.9 mi. N Windsor, Hoggard Mill Cr. at SR 1301 (36°1'38.20"N, 76°57'6.25"W); Cartaret Co., Portsmouth Island, Portsmouth village, freshwater pond in sand dunes (35°4'14.24"N, 76°3'51.66"W); Columbus Co., Lake Waccamaw, canal near NW shore of L. Waccamaw (34°17'26.41"N, 78°28'26.13"W); Wake Co., 5.0 mi. SW Raleigh center, Yates Mill Pond (35°43'14.12"N, 78°41'20.68"W). **North Dakota**, McLean Co., 5.0 mi. N Turtle Lake, pond alongside ND 41 (47°35'43.04"N, 100°54'17.12"W). **Ohio**, Ashland Co., Ashland, creek at OH 58 (40°53'20.46"N, 82°18'2.14"W); Huron Co., 4.5 mi. E North Fairfield, creek at OH 162, 1.0 mi. W jct. US 520 (41°6'4.09"N, 82°31'26.16"W). **Wisconsin**, Sawyer Co., 4 mi. NE Winter, creek at WIS 70 (45°52'7.43"N, 90°58'0.58"W).

**Hosts.** Canada: *Hyalella azteca* (all areas of host body). Mexico: *Hyalella azteca* (all areas of host body). Uruguay: *Hyalella curvispina* (all areas of host body). USA: *Hyalella azteca*, *Gammarus lacustris lacustris*, *Gammarus* sp. (all areas of host body).

**References.** Felgenhauer 1979; Clamp 1984, 1990a; Mayén-Estrada & Aladro-Lubel 2006; \*\*present work.

**b. Restricted to Isopoda**

**i. Europe only**

***L. platei* Wallengren, 1900**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Germany: **Bavaria**, Erlangen, Botanical Garden; near Erlangen, upper Dechsenderfer-Weiher (49°35'56.67"N, 11°0'23.97"E). **North Rhine-Westphalia**, Bonn, Bonn Botanical Garden, Poppelsdorfer Weiher (50°43'25.36"N, 7°5'36.83"E). **Wurttemberg**, Freiburg-im-Breisgau, tanks of the zoological and biological institutes of the University of Freiburg (47°59'50.66"N, 7°51'52.88"E); Near Freiburg-im-Breisgau, Hugstetten (48°3'42.70"N, 7°47'3.30"E); "Hanflochern" ("hemp pits").

Poland: **Szczecin** (53°25'23.86"N, 14°33'42.62"E).

Sweden: **Malmöhus**, near Lund (55°36'27.12"N, 12°58'15.56"E).

**Hosts.** Germany: *Asellus aquaticus* (Linnaeus) (gills). Poland: *Asellus aquaticus* (gills). Sweden: *Asellus aquaticus* (gills).

**References.** Piesik 1976; Clamp 1984.

***L. monolistræ* Stammer, 1935**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Italy: **Vicenza**, Monti Berici (group of hills south of city of Vicenza), near Monticello, Covolo delle Tette (cave) (45°28'17.46"N, 11°31'22.83"E); Vicenza, Monti Berici, near Lumingnano, Covolo delle Guerra (cave) (45°27'18.27"N, 11°35'4.13"E).

Republic of Croatia: **Istra**, near Pinguente, Pecina Glavici (cave) (45°24'25.91"N, 13°58'2.04"E).

Republic of Slovenia: **Podpec**, Podpec-Hohle (cave) (45°58'14.22"N, 14°25'6.68"E).

**Hosts.** Italy: *Monolistræ (Typhlosphaeroma) bericum* (Fabiani) (cited as *Monolistræ berica*) (gills). Republic of Croatia: *Monolistræ racovitzae* Strouhal (gills). Republic of Slovenia: *Monolistræ caeca* Gerstaecker.

**References.** Clamp 1984.

**ii. Broad Distribution**

***L. aselli* Plate, 1889**

**Museum Depositions.** USNM. 40923, 40924, 40925, 40926, 40927.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Canada: **Ontario**, Carleton Co., Rideau R. below Ottawa (45°23'22.30"N, 75°40'40.17"W); Lanark Co., 8 km E Perth, Cockburn Cr. at ONT 43 (44°53'43.32"N, 76°10'50.69"W); Norfolk Co., 4.2 km S Port Rowan, marsh alongside ONT 59 at head of Long Point (42°35'8.66"N, 80°26'58.51"W); Norfolk Co. Long Point Provincial Park, Long Point Bay alongside ONT 59 (42°34'46.86"N, 80°23'4.30"W). **Quebec**, L'Islet Co., St. Jean-Port-Joli, mouth of Rivière Tortue at QUE 2 (47°08'56"N, 70°20'21"W).

Denmark: **South Jutland**, near Ribe, brook at Vedsted (57°8'57.30"N, 9°41'55.45"E).

France: **Bretagne**, Finistère Nord. 1 km SSE Plougarneau, creek at highway D32 (48°36'1.49"N, 4°29'54.81"W); Pont-Menou, Douron R. at highway N786 (48°38'40.63"N, 3°39'43.27"W).

Germany: **Bavaria**, near Erlangen: pond near Oberndorf (50°41'56.64"N, 8°27'19.69"E); Bade-Weiger; Regnitz-uferzone. **Hamburg**, near Hamburg (53°33'2.37"N, 9°59'36.21"E). **Hessen**, Marburg (50°45'44.07"N, 8°44'30.59"E). **North Rhine-Westphalia**, Bonn, Bonn Botanical Garden (50°43'22.72"N, 7°5'27.39"E); Poppelsdorfer Weiher. **Wurttemberg**, Freiburg im Breisgau, University of Freiburg (47°59'50.66"N, 7°51'52.88"E).

UK: **Liverpool** (no locality given).

USA: **Alabama**, Mobile Co. Mobile, Mobile Bay at mouth of Mobile R. (30°39'60.00"N, 88° 1'35.82"W).

**Delaware**, Kent Co., Milford, Haven L. (38°54'43.57"N, 75°27'1.61"W); Kent Co., 2.7 km N Cheswold, Garrison's L. (39°14'36.47"N, 75°35'37.72"W). **Louisiana**, Vermilion Parish, Pecan Island, canal

alongside Louisiana 82, 1.3 km S Schooner Bayou Canal (29°44'1.26"N, 92°19'56.23" W). **Michigan**, Ottawa Co., 8 km S Grandhaven, slough at Lakeshore Dr. (42°59'30.04"N, 86°13'11.53"W). **New York**, Oswego Co., 3 km S Southwest Oswego, Eightmile Cr. at New York 104 (43°22'52.48"N, 76°34'27.57"W); Oswego Co., 2.7 km N New Haven, Catfish Cr. at Co. Rd. 1 (43°30'47.19"N, 76°19'24.80"W); Oswego Co., 8.5 km WSW Sandy Creek center, Sandy Pond (North Pond) at Ouderkirk Rd. (43°37'54.58"N, 76°11'17.70"W); Oswego Co., 4.5 km SSW West Monroe, Oneida Lake at Shaw's Point (43°14'42.92"N, 76° 5'34.37"W). **North Carolina**, Tyrrell Co., Gum Neck Landing, state boating access area at end SR 1316 (35°41'50.15"N, 76°6'35.06"W); Tyrrell Co., 2.1 km NW Columbia, ditch alongside SR 1209 (35°56'10.88"N, 76°16'34.27"W); Wayne Co., 6.9 km NNE Dobbersville, Beaverdam Cr., at SR 1105 (35°17'7.47"N, 78°13'17.74"W). **Oregon**, Klamath Co., 19 km N Klamath Falls, Barkley Springs (42°23'53.78"N, 121°45'48.01"W). **South Carolina**, Lynches Co., Lynches River State Park, Lynches R. (34°2'13.90"N, 79°47'4.48"W). **Wisconsin**, Bayfield Co., 3.2 km S Barksdale, creek at Wisconsin 13 near jct. U.S. 2 (46°35'51.88"N, 90°57'17.52"W); Bayfield Co., 6.4 km N Washburn, Sioux Creek Slough at Wisconsin 13 (46°43'56.18"N, 90°52'40.43"W); Sawyer Co., 6.4 km NE Winter, creek at Wisconsin 70 (45°52'7.33" N, 90°58'0.46"W); Sawyer Co., 8 km N Loretta, creek at Co. Rd. GG (45°57'24.54"N, 90°50'39.36"W).

**Hosts.** Canada: *Caecidotea communis* (Say) (cited as *Asellus communis*), *C. racovitzai racovitzai* (Williams) (cited as *Asellus racovitzai racovitzai*) (pleopods). Denmark: *Asellus aquaticus* (gills). France: *Asellus aquaticus* (pleopods). Germany: *Asellus aquaticus* (underside of gills). UK: *Asellus aquaticus* (pleopods). USA: *Asellus* sp. (pleopods and pereopods), *Caecidotea attenuata* (Richardson) (cited as *Asellus attenuatus*) (pleopods and pereopods), *C. communis* (Say) (cited as *Asellus communis*) (pleopods), *C. forbesi* (Williams) (cited as *Asellus forbesi*) (pleopods and pereopods), *C. laticaudata* (Williams) (cited as *Asellus laticaudatus*), *C. occidentalis* (Williams) (cited as *Asellus occidentalis*), *C. racovitzai racovitzai* (Williams) (cited as *Asellus racovitzai racovitzai*) (pleopods), *Lirceus lineatus* (Say) (pleopods), and suspended glass slide.

**References.** Clamp 1984, 1988 b; Roberts & Chubb 1998; Fernandez-Leborans & Tato-Porto 2000.

#### c. Decapoda

##### i. North America only

##### *L. dennisi* Clamp, 1987

**Museum Depositions.** USNM. 40928 Holotype; 40929 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Mexico: **Michoacán**, Pátzcuaro Lake (19°32' to 19°41' N, 101°32' to 101°43' W).

USA: **Missouri**, Jefferson Co., 4.3 km NNE Hillsboro, creek running parallel to MO 21 at Hayden Rd. (38°16'14.36"N, 90°33'21.04"W). **North Carolina**, Franklin Co., 10.4 km E Youngsville, Crooked Cr. at US 401 (36°0'44.25"N, 78°21'40.00"W). **Virginia**, Grayson Co., 5.1 km S Independence, creek tributary to New R. at US 21-221 bridge (36°34'34.63"N, 81°9'27.31"W).

**Hosts.** Mexico: *Cambarellus patzcuarensis* Villalobos (exposed body surface). USA: *Cambarus* (*Cambarus*) *bartonii bartonii* (Fabricius, 1798), *C. chasmodactylus* James, *Orconectes illinoiensis* Brown (exposed body surface).

**References.** Clamp 1987a; Fernandez-Leborans & Tato-Porto 2000; Mayén-Estrada & Aladro-Lubel 2000; Fernandez-Leborans 2009.

##### *L. diogenes* (Jankowski, 1986)

*Circolagenophrys diogenes* Jankowski 1986: 81-82.

*Lagenophrys incompta* Clamp 1987: 385-386.

**Museum Depositions.** USNM. 40930 Holotype; 40931 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic.

USA: **Pennsylvania** (41°11'58.50"N, 77°11'47.26"W). **Missouri**, Jefferson Co. 4.3 km NNE Hillsboro, creek running parallel to MO 21 at Hayden Rd. (38°16'14.36"N, 90°33'21.04"W).

**Hosts.** USA: *Cambarus diogenes* Girard (gills), *Orconectes illinoiensis* (gills and branchial chamber).

**References.** Jankowski 1986; Clamp 1987a; Fernandez-Leborans & Tato-Porto 2000; Fernandez-Leborans 2009.

***L. leniusculus* (Jankowski, 1986)**

*Lagenophrys oregonensis* Clamp 1987: 386-387.

*Circolagenophrys leniusculus* Jankowski 1986: 80.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

USA: **Nevada** Storey Co. Reno, Truckee (39°36'23.04''N, 119°18'12.21''W). **Oregon**, Lincoln Co. 3.2 km NW Eddyville, Marys R. alongside US 20 (44°39'17''N, 123°48'37.03''W); Harney Co. near Drewsey, Malheur R. (43°48'42''N, 118°22'32.8''W). **Washington**, Wahkiakum Co. Deep R. at Peter McKinnon log dump (46°19'47.65''N, 123°41'52.30''W).

**Hosts.** USA: *Pacifastacus connectens* (Faxon), *P. leniusculus leniusculus* (Dana), *P. leniusculus trowbridgii* (Stimpson) (gills and other corporal surfaces).

**References.** Jankowski 1986; Clamp 1987a; Fernandez-Leborans & Tato-Porto 2000; Fernandez-Leborans 2009.

***L. metopauliadis* Corliss and Brough, 1965**

**Museum Depositions.** USNM. 24241 Holotype; 24242 Paratype.

**Habitat.** Freshwater (tank epiphytic bromeliads).

**Distribution.** BR: Neotropical.

Jamaica: **West Indies** (18°5'24.50"N, 77°17'35.26"W).

**Hosts.** Jamaica (West Indies): *Metopaulias depressus* Rathbun (gills).

**References.** Corliss & Brough 1965; Fernandez-Leborans & Tato-Porto 2000.

***L. verecunda* Felgenhauer, 1982**

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic.

USA: **Arkansas**, Monroe Co., 6.3 mi. E Holly, Big Cypress Cr. at ARK 86 (34°36'7.09"N, 91°5'19.85"W).

**Florida**, Lake Jackson, Leon Co. (30°31'21.58"N, 84°19'19.93"W); near Tallahassee (30°30'22.18"N, 84°18'33.02"W); Levy Co., 4 mi. NW Bronson, Little Waccasassa R. at FL 339 (29°29'26.51"N, 82°42'23.03"W).

**Hosts.** USA: *Palaemonetes kadiakensis*, *P. paludosus* (gills).

**References.** Felgenhauer 1982; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

**iii. Asia only**

***L. branchiarum* Nie and Ho, 1943**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

China: **Sichuan** (Szechwan) (30°33'18.53"N, 103°55'51.45"E); Beibei (Pehpei), pond near National Institute of Zoology and Botany, Academia Sinica (29°48'11.07"N, 106°23'44.05"E).

**Hosts.** China: *Macrobrachium nipponense* (De Haan, 1849) (cited as *Macrobrachium nipponensis*) (gills).

**References.** Clamp 1984.

**d. Restricted to Other Hosts (Copepoda, Cladocera, Ostracoda)**

***L. bipartita* Stokes, 1890**

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic.

USA: no locality given.

**Hosts.** USA: *Daphnia* sp. (surface of body).

**References.** Green 1974; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

***L. discoidea* Kellicott, 1887**

*Lagenophrys discoidea* Kellicott 1887: 232; Kane 1965: 121.

*Lagenophrys labiata* Wallengren 1900: 359-363; von Ubisch 1913: 43, 44, 46, 47, 75; Monard 1920: 104; Keiser 1921: 286-287, 291; Penard 1922: 304-308, 313, 314; Abonyi 1928: 9, 18; Swarczewsky 1930: 457, 458, 460, 464, 503; Mouchet-Bennati 1932: 149; Wang and Nie 1933: 89-90; Willis 1942: 172; Finley 1943: 113; Finley 1946: 70-71; Debaisieux 1959: 369; Felgenhauer 1979: 591 (species reported on ostracods).

*Lagenophrys wallengreni* Abonyi 1928: 9, 18; Kahl 1935: 794, 796, 797; Lust 1950: 351-352; Kane 1965: 121; Stiller 1971: 227; Felgenhauer 1979: 591, 594.

*Circolagenophrys entocytheris* Jankowski 1986: 79-80, 88.



**Museum Depositions.** USNM. 42309 Neotype; 42310, 42311, 42312, 42313, 42314, 42315.

**Habitat.** Freshwater.

**Distribution.** BR: Neartic, Neotropical, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Argentina: **Buenos Aires**, San Miguel del Monte lagoon.

Canada: **Ontario**, 3.2 km WSW Crystal Beach, Point Abino, swamp at jct. Pt. Abino Rd./Erie Rd. (42°51'32.60"N, 79°5'42.16"W).

China: **Jiangsu** (Kiangsu) (32°2'55.10"N, 118°45'12.50"E); Najing (Nanking) (32°3'49.84"N, 118°47'52.24"E).

Sweden: **Malmöhus**, near Landskrona, small pond at the base of the Ronnebergagård (55°52'31.71"N, 12°50'32.15"E).

Switzerland: **Solothurn**, Seewen lake (47°25'43.26"N, 7°39'41.50"E). **Basel**, near Basel, Schusterinsel (47°33'21.07"N, 7°35'38.05"E). French portion of Switzerland, near Behringersmühl, Stempfermühl spring.

Ukraine: Dnieper Basin (47°38'26.35"N, 35°5'10.30"E).

USA: **Florida**, Franklin Co., 10.7 km N Carrabelle, flooded pit alongside state secondary road 67 (29°56'42.60"N, 84°37'52.98"W). **Georgia**, McIntosh Co., Sapelo Island, ponds near ocean beach at S end of island (31°23'6.38"N, 81°16'37.34"W). **Illinois**, Lake Charleston, Coles Co. (39°28'10.99"N, 88°9'2.08"W). **Louisiana**, Orleans Pa., 2.9 km S Green's Ditch, oxbow of Bayou LeSaire alongside U.S. 90 (30°7'0.81"N, 89°45'48.45"W). **Michigan**, Oakland Co., 7.2 km SW Pontiac, ditch running into Pine L. at N shore (42°37'38.06"N, 83°19'5.66"W). **Missouri**, Jefferson Co., 2.4 km NE De Soto center, Joachim Cr. at MO 110 (38°9'30.83"N, 90°32'46.34"W); Jefferson Co., 4.3 km NNE Hillsboro, creek running parallel with State Highway 21 at Hayden Rd. (38°16'14.36"N, 90°33'21.04"W). **New York**, Oswego Co., 4.5 km SSW West Monroe, swamp near Oneida Lake alongside Shaw Dr. (43°14'45.40"N, 76°6'4.01"W); Oswego Co., 8.6 km WSW Sandy Creek center, Sandy Pond (North Pond) at Ouderkirk Rd. (43°37'54.58"N, 76°11'17.70"W). **North Carolina**, Alleghany Co., 3.0 km NW Twin Oaks, New R. at state secondary road 1345 (36°33'4.15"N, 81°10'54.11"W); Franklin Co., 10.4 km E Youngsville, Crooked Cr. at U.S. 401 (36°0'44.25"N, 78°21'40.00"W); Onslow Co., Topsail Island, West Onslow Beach, pond just S jct. NC 210 with state secondary road 1568 (34°29'27.25"N, 77°25'35.51"W); Tyrrell Co., Columbia, drainage ditch (35°55'11.93"N, 76°15'17.23"W); Wake Co., 6.4 km E Rolesville, Little R. upstream from state secondary road 2224 (35°55'0.42"N, 78°23'45.83"W). **Oregon** (45°36'41.35"N, 122°31'25.24"W). **Virginia**, Grayson Co., 5.1 km S Independence, New R. at U.S. 21-221 (36°34'34.63"N, 81°9'27.31"W).

**Hosts.** Argentina: *Heterocypris similis* (Wierzejski) (cited as *Cyprinotus similis*) (lateral and marginal surface of carapace). Canada: *Cypris* sp., *Candona elliptica* Furtos, *Candona* sp. (external surface carapace). China: *Cypris* sp. (carapace). Sweden: small, greenish ostracods. Switzerland: *Cyclocypris ovum* (Jurine), *Cypridopsis vidua* (O. F. Mueller), *Candona neglecta* G. O. Sars, *Cypria ophthalmica* (Jurine) (carapace). Ukraine: *Cypris* sp., *Eucypris* sp. USA: (in all cases on external surface carapace): *Ankylocythere hobbsi* (Hoff), *A. ancyla* (Crawford), *Candona neglecta*, *Chlamydotheca arcuata* (Sars), *Cyclocypris ovum*, *C. sharpei* Furtos, *Cypria obesa* Sharpe, *C. ophthalmica*, *Cypridopsis vidua* (O. F. Mueller), *Dactylocythere daphniodes* (Hobbs), *D. jeanae* Hobbs, *Donnaldsoncythere donnaldsonensis* (Kie), *Thermastrocythere riojai* (Hoff).

**References.** Clamp 1984, 1990a; Boshko 1992; Claps & Sampóns 1994.

#### ***L. stammeri* Lust, 1950**

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Germany: **Bavaria**, near Hersbruck, Hersbrucker Quelle (spring) (49°30'17.09"N, 11°27'45.46"E).

**Hosts.** Germany: *Cypria ophthalmica* (Jurine) (external surface of carapace).

References. Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

#### ***L. vaginicola* Stein, 1852**

*Lagenophrys obovata* Stokes 1887: 147; Stokes 1888: 59; von Ubisch 1913: 43; Swarczewsky 1930: 458; Kane 1965: 120, 121.

*Lagenophrys vaginicola* Wallengren 1900: 358, 360, 362; von Ubisch 1913: 42, 43, 44, 52, 75.

**Habitat.** Freshwater.

**Distribution.** BR: Neartic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Austria: **Voralberg**, 7 mi. SSW Bludenz, Lunersee (47°3'22.96"N, 9°45'48.29"E).

Canada: **Ontario**, 2.0 mi. WSW Crystal Beach, Point Abino, swamp at jct. Pt. Abino Rd./Erie Rd. (42°51'32.60"N, 79° 5'42.16"W).

China: **Jiangsu** (Kiangsu), Nanjing (Nanking) (32°2'55.10"N, 118°45'12.50"E).

France: Haute-Savoie Lac d'Annecy (45°52'3.92"N, 6°11'9.30"E).

Germany: **Bavaria**, near Erlangen (49°35'35.32"N, 10°59'33.19"E). **Potsdam**, Niemege (52°4'58.44"N, 12°42'0.17"E). **Wurttemberg**, Freiburg-im-Breisgau, Hochdorf (47°59'50.66"N, 7°51'52.88"E).

Slovakia: High Tatra Mountains near Kezmarck, lakes Kezsmarker Gruner-See, Kezsmarker Schwarzer-See, Kezsmarker Weisser-See (49°9'6.17"N, 20°12'31.08"E).

Switzerland: **Basel**, Dornach, meadow ponds (47°28'57.41"N, 7°36'30.90"E). **Geneve**, near Geneva, Pinchat (46°10'22.17"N, 6°8'49.81"E); near Geneva, Rouelbeau, marsh (46°14'30.78"N, 6°13'5.68"E); near Geneva, Florissant, small pond (46°11'37.11"N, 6°9'34.29"E); near Geneva, Valavaran, bog; Lac Leman, littoral region (46°12'34.31"N, 6°9'46.48"E); near Geneva, Chatelaine Lake; near Geneva, Vieuxseux, lake; near Geneva, Feuillasse, marsh.

USA: **Delaware**, 1.7 mi. N Cheswold, Garrison's L. (39°14'39.94"N, 75°35'39.04"W). **New Jersey**, Mercer Co., near Trenton (40°12'17.84"N, 74°46'1.66"W). **New York**, Erie Co., near Buffalo, early spring (42°52'38.02"N, 78°52'53.41"W). **North Carolina**, Tyrrell Co., 2.5 mi. NW Columbia, swamp at jct. SR 1209/SR1211 (35°56'50.53"N, 76°16'52.58"W); Tyrrell Co., 1.5 mi. NW Columbia, swamp alongside SR 1209 (35°56'6.61"N, 76°16'11.05"W); Washington Co., 1.8 mi. SW Creswell, swampy margin of Scuppernong (35°51'14.00"N, 76°25'5.02"W).

**Hosts.** Canada: harpacticoid copepod (caudal bristles). China: *Canthocamptus* sp. (caudal bristles). Germany: *Canthocamptus staphylinus* (Jurine) (swimming legs and caudal bristles), *Cyclops* sp. Switzerland: *Canthocamptus staphylinus* (caudal bristles), *Canthocamptus* sp., *Metacyclops minutus* (Claus) (cited as *Cyclops minutus*), *Cyclops* sp. USA: harpacticoid copepod (caudal bristles), *Bryocamptus minutus* (Claus) (setae of swimming legs, caudal bristles), *Canthocamptus* sp.

**References.** Clamp 1984.

## 2. Southern Hemisphere (Restricted to Decapoda)

### a. South America only

#### *L. aegleae* Mouchet-Bennati, 1932

**Museum Deposition.** USNM: 40919, Neotype.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical (Mayén-Estrada & Aguilar-Aguilar 2012).

Brazil: East of the Andes; **Paraná**, eastern portion (25°1'15.71"S, 50°2'2.17"W). **Sao Paulo**, Franca (20°33'27.58"S, 47°25'17.58"W).

Uruguay: **Montevideo**, Arroyo Miguelete (34°51'25.92''S, 56°12'08.65''W).

**Hosts.** Brazil: *Aegla castro* Schmitt, *A. franca* Schmitt, *Aegla* sp. (gills). Uruguay: *Aegla* sp. (gills).

**References.** Mouchet-Bennati 1932; Clamp 1988c; Fernandez-Leborans & Tato-Porto 2000.

#### *L. andos* (Jankowski, 1986)

*Circolagenophrys andos* Jankowski 1986: 82.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Valparaíso** (33°2'34.35"S 71°36'58.27"W).

**Hosts.** Chile: *Parastacus pugnax* (Poeppig) (cited as *Parastacus chilensis*) (gills).

**References.** Jankowski 1986; Fernandez-Leborans & Tato Porto 2000.

#### *L. antichos* Clamp, 1988

USNM. 40920 Holotype ; 40921, 40922 Paratypes.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical (Mayén-Estrada & Aguilar-Aguilar 2012).

Brazil: **Rio Grande Do Sul**, Bagi (29°32'4.22''S, 53°23'26.18''W), Mello.

Chile: **Concepción**, Talcahuano (36°43'26.14''S, 73°6'47.16''W). **Valdivia**, Isla Teja (39°48'9.37''S, 73°15'45.36''W). **Malleco**, Puren (38°2'33.95"S, 73°5'11.39"W).

Uruguay: **Montevideo** (34°54'57.80"S, 56°11'12.22"W).

**Hosts.** Brazil: *Parastacus defossus* Faxon, *P. varicosus* Faxon (gills). Chile: *Parastacus nicoleti* (Philippi), *P. pugnax* (Poepig) (gills). Uruguay: *Parastacus saffordi* Faxon (gills).

**References.** Clamp 1988c; Fernandez-Leborans & Tato-Porto 2000.

***L. shiftus* (Jankowski, 1986)**

*Circolagenophrys shiftus* Jankowski 1986: 82.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Valparaíso** (33°2'34.52"S, 71°37'10.21"W).

**Hosts.** Chile: *Parastacus pugnax* (cited as *Parastacus chilensis*) (gills).

**References.** Jankowski 1986.

**b. Australia and New Guinea only**

***L. darwini* Kane, 1965**

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Northern Territory**, stream near Darwin (12°27'58.96"S, 130°50'26.26"E).

**Hosts.** Australia: *Cherax quadricarinatus* (von Martens) (gills).

**References.** Kane 1965; Fernandez-Leborans & Tato-Porto 2000.

***L. deserti* Kane, 1965**

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Western Australia**, rivers in southwestern part of state (30°45'56.57"S, 119°29'0.06"E).

**Hosts.** Australia: *Cherax quinquecarinatus* Gray, *C. tenuimanus* (Smith) (gills).

**References.** Kane 1965; Fernandez-Leborans & Tato-Porto 2000.

***L. dungogi* Kane, 1965**

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **New South Wales**, stream near Dungog (32°24'5.93"S 151°45'37.73"E). Near Hornsby, Galston Gorge, Berowra Cr. (33°34'37.26"S, 151°7'40.82"E).

**Hosts.** Australia: *Euastacus clydensis* Riek, *Euastacus* sp. (gills).

**References.** Kane 1965; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

***L. engaei* Kane, 1965**

**Habitat.** Freshwater.

**Distribution.** BR: Australian (Mayén-Estrada & Aguilar-Aguilar 2012).

Australia: **Victoria**, Melbourne, 20 miles east of Melbourne, near Sylvan dam (37°49'7.80"S, 145°20'1.50"E); near Mt. Dandenong (37°49'46.29"S, 145°24'10.78"E). **Tasmania** (41°21'43.79"S, 146°37'33.31"E).

**Hosts.** Australia: *Engaeus hemicirratulus* Smith & Schuster (gills, pleopods and exposed surface), *E. victoriensis* Smith and Schuster (gills), *Engaeus* sp. (gills, pleopods and exposed surface).

**References.** Kane 1965; Fernandez-Leborans & Tato-Porto 2000.

***L. jacobi* (Kane, 1969)**

*Stylohedra jacobi* Kane 1969:368-369.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Victoria**, near Melbourne. **Tasmania** (no locality given). **New South Wales** (no locality given).

**Hosts.** Australia: *Engaeus fultoni* Smith and Schuster (setae), *E. hemicirratulus*, *Engaeus* sp., *Euastacus* spp., *Cherax rotundus* Clark, *Colubotelson* sp. (regions not specified).

**References.** Kane 1969.

***L. petila* Clamp, 1994**

**Museum Depositions.** USNM. 47734 Holotype; 47735 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Australian (Mayén-Estrada & Aguilar-Aguilar 2012).

Australia: **Tasmania**: Derwent Bridge (42°8'6.97"S, 146°13'52.68"E).

**Hosts.** Australia: *Parastacoides tasmanicus* (Erichson) (setae of gills and pleopods).

**References.** Clamp 1994.

***L. rugosa* Kane, 1965**

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Victoria**, Grampian mountains of western Victoria (37°8'6.91"S, 142°30'57.33"E); 15 mi. N Orbost (37°30'46.11"S, 148°27'10.29"E); Grampian mountains, Wannon R. (37°31'35.60"S, 142°11'29.73"E).

**Hosts.** Australia: *Engaeus marmoratus* Clark (gills), *Geocharax falcata* Clark (gills).

**References.** Kane 1965; Fernandez-Leborans & Tato-Porto 2000.

***L. turneri* Kane, 1969**

*Lagenophrys turneri* Kane 1969: 369. Clamp 1991: 358.

*Circolagenophrys turneri* Jankowski 1986: 87.

**Museum Depositions.** AM P62821 Lectotype. USNM. 1004293 Paralectotype; 1004294.

**Habitat.** Freshwater.

**Distribution.** BR: Australian (Mayén-Estrada & Aguilar-Aguilar 2012).

Australia: **Northern territory**, Katherine, Katherine R. (14°30'22.21"S, 132°13'0.10"E).

Papua New Guinea: Gulf District near Malalaua, Lake Kamu R. (146° 8'48.29"E, 146° 8'48.29"E).

**Hosts.** Australia: *Macrobrachium rosenbergii* de Man (gills). Papua New Guinea: *M. rosenbergii* (gills).

**References.** Fernandez-Leborans & Tato-Porto 2000; Clamp & Kane 2003.

***L. willisi* Kane, 1965**

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Victoria**, Craigburn, Merri Cr. (37°34'17.95"S, 144°57'39.34"E); Hamilton, W. (37°44'17.22"S, 142°2'20.47"E); Melbourne, outer Melbourne suburbs of Watsonia and Panton Hills (37°41'38.29"S, 145°10'38.17"E); Watsonia (suburb of Melbourne) (37°42'43.03"S, 145°4'20.59"E); Panton Hill (suburb of Melbourne) (37°38'29.28"S, 145°14'20.15"E). **New South Wales**, Newcastle (32°56'30.47"S, 151°46'17.52"E).

**Hosts.** Australia: *Cherax albidus* Clark, *C. destructor* Clark, *C. rotundus*, *C. rotundus setosus* (gills).

**References.** Kane 1965; Fernandez-Leborans & Tato-Porto 2000.

**c. New Zealand only**

***L. novazealandae* Clamp, 1994**

**Museum Depositions.** USNM. 47731 Holotype; 47732, 47733 Paratypes.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

New Zealand: South Island, Canterbury (Honoret Race) (43°59'19.82"S, 170°52'24.91"E).

**Hosts.** New Zealand: *Paranephrops setosus* Hutton, *P. zealandicus* (White) (bases and filaments of gills).

**References.** Clamp 1984, 1994.

**d. South Africa only**

***L. reflexa* Kane, 1969**

*Stylohedra reflexa* Kane 1969: 369.

**Habitat.** Freshwater.

**Distribution.** BR: Ethiopian.

South Africa (no locality given).

**Hosts.** South Africa: *Mesamphisopus capensis* (Barnard) (setae).

**References.** Kane 1969.

**e. Madagascar only**

***L. machaerigera* Clamp, 1992**

**Museum Depositions.** USNM. 43090 Holotype; 43091, 43092, 43093 Paratypes.

*Circolagenophrys machaerigera* Jankowski 1993: 221.

**Habitat.** Freshwater.

**Distribution.** BR: Ethiopian.

Madagascar, central portion (19°13'28.96"S, 46°41'32.86"E).

**Hosts.** Madagascar: *Foza goudoti* (H. Milnes Edwards) (cited as *Gecarcinautes goudoti*) (gills).



**References.** Clamp 1984, 1992.

### 3. Broad Distribution

#### *L. awerinzewi* Abonyi, 1928

**Habitat.** Freshwater.

**Distribution.** BR: Australian, Ethiopian, Oriental (Mayén-Estrada & Aguilar-Aguilar 2012).

Burma: Upper Tenasserim (12°27'52.85"N, 99°0'36.72"E).

China: **Guangdong** (Kwangtung) Hainan Dao (Hainan) near Kachek, Mt. Betcholia (22°34'40.30"N, 114°53'52.48"E). **Shandong** (Shantung) (36°39'51.00"N, 117°1'11.16"E); Jinan (Tsinan) (36°38'58.42"N, 117°7'12.47"E); Taminghu. **Sichuan** (Szechwan) (30°33'18.53"N, 103°55'51.45"E); Yibin (Ipin) (28°46'11.66"N, 104°38'30.66"E); Suifu.

India: **Assam** (26°11'25.88"N, 92°56'11.41"E); Ganjam (12°58'53.64"N, 77°37'0.60"E); North Cachar (24°46'11.42"N, 92°51'24.28"E). **Maharashtra** (19°40'18.68"N, 75°43'2.54"E); Khandala (18°45'26.30"N, 73°22'20.23"E); Bombay (19°4'31.02"N, 72°52'20.53"E); Kolaba (18°18'39.15"N, 72°57'35.55"E). **Tamil Nadu** (11°7'14.16"N, 78°39'31.33"E); Madras (11°43'19.44"N, 78° 3'5.68"E); Shevaroy Hills (11°50'37.30"N, 78°13'28.24"E).

Liberia: **Gbarnga District**, stream tributary to St. John's R. (6°59'52.89"N, 9°29'15.84"W).

Malaysia: **North Borneo**, Mt. Kinabalu (6°3'48.09"N, 116°32'47.58"E).

New Guinea (no locality given).

Taiwan: **Hsinchu** (24°47'57.40"N, 120°57'23.01"E); Hsien (22°36'57.05"N, 120°17'31.61"E); Kungse.

Tanzania: **Tanga** (5°4'7.12"S, 39° 5'59.15"E); Amani (5°7'3.90"S, 38°37'55.16"E).

Thailand: **Udon** (Udon Thani) (17°27'7.94"N, 102°46'21.20"E).

Uganda: **Entebbe** (0°3'3.39"N, 32°27'53.46"E).

**Hosts.** Burma: *Demanietta manii* (Rathbun) (cited as *Potamon manii* (gills). China: *Apotomonautes hainanensis hainanensis* (Parisi) (cited as *Potamon hainanense*) (gills), *Potamon denticulatus* (Milne-Edwards) (gills), *Sinopotamon davidi* (Rathbun) (cited as *Potamon davidi*) (gills). India: *Barythelphusa guerini* (H. Milne Edwards) (cited as *Parathelphusa guerini*) (gills), *Maydelliathelphusa falcidigitis* (Alcock) (cited as *Parathelphusa falcidigitis*), *Parathelphusa cunicularis* Westwood. Liberia: *Liberonautes latidactylus* (de Man) (cited as *Potamon latidactylus*) (gills). Malaysia: *Isolapotamon kinabaluense* (Rathbun) (cited as *Potamon kinabaluensis*) (gills). New Guinea: *Holthuisana vanheurni* (Roux) (cited as *Parathelphusa vanheurni*) (gills). Taiwan: *Potamon dehaani* (Otsu) (gills). Tanzania: *Potamon* sp. (gills). Thailand: *Esanthelphusa dugasti* (Rathbun) (cited as *Parathelphusa dugasti*) (gills). Uganda: *Potamonautus niloticus* (H. Milne Edwards) (cited as *Potamon niloticus*) (gills).

**References.** Clamp 1984.

### B. Marine, Estuarine, Euryhaline

#### 1. Restricted to Amphipoda

##### *L. anisogammari* (Jankowski, 1993)

*Circolagenophrys anisogammari* Jankowski 1993: 220-221.

**Habitat.** Marine.

**Distribution.** BR: Palaeartic.

Russia: **Southern Sakhalin** on the boundary of the Sea of Japan and the Sea of Okhotsk, Busse lagoon (45°53'30.59"N, 142°4'52.32"E).

**Hosts.** Busse lagoon: *Anisogammarus* sp. (branchial plates).

**References.** Jankowski 1993; Clamp & Kane 2003.

##### *L. crutchfieldi* Clamp, 1993

*Circolagenophrys crutchfieldi* Jankowski, 1993: 221.

**Museum Depositions.** USNM. 43086 Holotype; 43087, 43088, 43089 Paratypes.

**Habitat.** Marine, estuarine.

**Distribution.** BR: mainly Neotropical (Mayén-Estrada & Aguilar-Aguilar 2012).

Brazil: **Santa Catarina**, Ilha de Santa Catarina (27°36'7.31"S, 48°30'4.70"W); Santa Catarina, Ilha de Sao Francisco (26°19'25.69"S, 48°38'22.79"W).

Dominican Republic: **Boca de Infierno**, small beach on southern shore of Bahia de Samana (19°10'50.15"N, 69°16'22.23"W).

Mexico: **Baja California**, La Paz (24°8'44.26"N, 110°20'23.26"W).

USA: **Florida**, Monroe Co., West Summerland Key at Spanish Harbor Channel (24°40'N, 81°20'W); Monroe Co., 7.5 mi. NNE Key Largo, Barnes Sound alongside U.S. 1 (25°11'N, 80°17'W).  
Virgin Islands: **St. Croix**, mangrove island, Salt River lagoon (17°41'10.78"N, 64°53'2.80"W).  
**Hosts.** Brazil: *Parhyale hawaiiensis* (Dana) (gills). Dominican Republic: *Parhyale hawaiiensis* (gills). Mexico: *Parhyale penicillata* Shoemaker (gills and near pereopods). USA: *P. hawaiiensis*, *Parhyale* sp. (gills). Virgin Islands: *P. hawaiiensis* (gills).

**References.** Clamp 1993.

***L. maxillaris* (Jankowski, 1993)**

*Lagenophrys* sp. Fenchel 1965: 290, 301.

*Circolagenophrys maxillaris* Jankowski 1993: 221.

*Lagenophrys maxillaris* Jankowski 1993: 221, Clamp & Kane 2003: 165.

**Museum Depositions.** BMNH. 1986.639.4. USNM. 1026201, 1026202.

**Habitat.** Brackish, marine.

**Distribution.** BR: Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Denmark: near Helsingborg, northern part of the Øresund, shore to below 5-6 m in depth (56°02'26.42"N, 12°37'18.53"E).

England: **Cornwall**, Looe Bay (50°21'05.02"N, 4°27'6.92"E).

France: **Bretagne**, Finistere-Nord, Isle de Siec (48°42'26.11"N, 4°03'58.56"E).

Norway: **Raunefjorden** (60°16'32.01"N, 5°12'32.66"E).

**Hosts.** Denmark: *Gammarus locusta* (Linnaeus), *G. oceanicus* Segerstrale (maxillipeds). England: *Gammarus locusta* (maxillipeds). France: *Gammarus locusta* (maxillipeds). Norway: *Gammarus locusta* (maxillipeds).

**References.** Fenchel 1965; Jankowski 1993; Clamp 2005; Fernandez-Leborans 2009.

***L. orchestiae* Abonyi, 1928**

**Habitat.** Freshwater, estuarine (semiterrestrial).

**Distribution.** BR: Nearctic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Hungary: **Transdanubia**, Revfulop, northern shore of Lake Balaton in the vicinity of the Biological Station (46°49'54.54"N, 17°38'48.34"E); Transdanubia, Abrahamhegy (village on northern shore of Lake Balaton) (46°48'48.66"N, 17°34'28.85"E).

Netherlands: **Noord-Holland**, Amstelmeer, Strandje Wieringen uit Aanspolsel (52°55'36.44"N, 4°57'45.45"E).

Russia. (no locality given).

USA: **Georgia**, McIntosh Co., Sapelo Island, salt marsh on grounds of University of Georgia Marine Institute (31°23'49.37"N, 81°16'51.22"W). **North Carolina**, Beaufort Co., 5.5 mi. ENE Bath, Banjo Cr. at SR 1718 (35°29'38.51"N, 76°42'52.22"W); Dare Co., Bodie Island, 5.5 mi. SSE Nags Head, creek at NC 12, 1.6 mi S jct. US 64/US 264 (35°53'2.95"N, 75°35'24.49"W).

**Hosts.** Hungary: *Orchestia cavimana* Heller (gills). Netherlands: *O. cavimana* (gills). Russia: *O. cavimana* (gills).

USA: *Orchestia uhleri* Shoemaker (gills).

**References.** Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

***L. tattersalli* Willis, 1942**

**Habitat.** Marine.

**Distribution.** BR: Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

France: **Bretagne**, Cotes-du-Nord, mouth of Trieux R., 2 mi. From Logui-de-la-Mer (48°49'21.70"N, 3°3'41.71"W).

UK: **Wales**, Glamorganshire coast near Swanbridge (51°23'59.25"N, 3°11'38.33"W).

**Hosts.** France: *Echinogammarus marinus* (Leach) (cited as *Gammarus marinus*) (gill plates). UK: *E. marinus* (cited as *Gammarus marinus*) (gill plates).

**References.** Willis 1942; Clamp 1984.

**2. Restricted to Isopoda**

***L. cochinensis* Santhakumari & Gopalan, 1980**

*Lagenophrys cochinensis* (*nomen nudum*) in Santhakumari 1976: 93-94, 96-98; *Lagenophrys cochinensis* in Santhakumari & Gopalan 1980: 126; Santhakumari & Nair 1982: 66; Santhakumari & Nair 1985: 220; Clamp 1991: 358; Clamp & Kane 2003: 165; Clamp 2005: 39, 41.

**Museum Depositions.** USNM. 1075882, 1075907, 1075917, 1075919, 1075922, 1075930, 1075931, 1075932, 1075933.

**Habitat.** Marine, estuarine.

**Distribution.** BR: Australian, Ethiopian, Nearctic, Neotropical (Mayén-Estrada & Aguilar-Aguilar 2012).

Cameroon: no locality given.

Cuba: **Bahia de Nuevitas**, mouth of Saramaguacan River.

India: **Kerala**, Cochin, Ramanthuruth area (9°58'54.80"N, 76°15'34.25"E); Kerala, Cochin, Cochin Backwater (9°58'52.78"N, 76°15'34.05"E); Southwest coast; Tamil Nadu, Pamban (9°16'11.58"N, 79°13'14.71"E) and Rameswaram (9°17'8.65"N, 79°18'58.22"E); Cochin Backwater, Kayamkulam Lake, Ayiramthengu; Cochin Backwater, Karunagappally (southern region of Kayamkulam Lake); Cochin Backwater, 0.3 km from barmouth, at Neendakara (8°56'23.09"N, 76°32'56.70"E); Cochin, Cochin Backwater, Aroor station (9°53'19.77"N, 76°17'53.83"E); Kerala, north shore of Cochin Harbor, pier in brackish water and from wooden craft; Tamil Nadu (11°7'14.16"N, 78°39'31.33"E); Madras (11°43'19.44"N, 78°3'5.68"E).

Kenya: **Mombasa**, Port Reitz area, Mwachi R. (4°2'21.99"S, 39°34'1.83"E).

Malaysia: Kedah, Putani, Sungei.

New Zealand: **North Island**, near Wellington, Pauatahunui, Inlet (41°6'14.68"S, 174°52'4.81"E); South Island, Kenepuru Sound (41°11'54.90"S, 173°57'33.13"E); North Island, Wairoa R. at Hawke's Bay (39°46'10.97"S, 176°44'3.82"E).

Philippines: **Aklan**, New Washington, fish pond (11°39'0.24"N, 122°25'40.05"E).

Thailand: **Nong Pang**, Bangpakong R.

USA: **California**, Humboldt Co., Humboldt Bay (40°43'10.25"N, 124°14'33.36"W); Alameda Co., Berkeley, Berkeley Marina (37°51'11.23"N, 122°18'28.86"W). **Florida**, Brevard Co., Grant, Indian River.

Venezuela: **Maracaibo** Bay (10°33'48.40"N, 71°35'59.40"W).

**Hosts.** Cameroon: *Sphaeroma terebrans* Bate (pleopods). Cuba: *S. walkeri* Stebbing (pleopods). India: *Ctenapseudes chilensis* (Chilton) (cited as *Aapseudes chilensis*) (mainly on posterior appendages but also on other parts of the body), *S. annandalei* Stebbing, *S. terebrans* (on all parts of body except some mouthparts), *S. triste* Heller (posterior appendages and other body areas as pleopods). Kenya: *S. terebrans* (pleopods). Malaysia: *S. triste* (pleopods). New Zealand: *S. quoyanum* H. Milne-Edwards, *Exosphaeroma planulum* Hurley and Jansen (pleopods). Philippines: *S. terebrans* Bate (pleopods). Thailand: *Sphaeroma* sp. (pleopods). USA: *S. quoyanum* H. Milne-Edwards (pleopods and posterior legs), *S. terebrans* (pleopods). Venezuela: *S. terebrans* (pleopods).

**References.** Santhakumari 1976; Santhakumari & Gopalan 1980; Santhakumari & Nair 1982, 1985; Clamp 2006; Fernandez-Leborans 2009.

### *L. limnoriae* Clamp, 1988

*Lagenophrys* sp. Mohr 1959: 87; Becker 1968: 315.

*Circolagenophrys circularis* Jankowski 1986: 79.

**Museum Depositions.** USNM. 39508 Holotype; 39509 Paratype.

**Habitat.** Marine.

**Distribution.** BR: Neartic, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Barents Sea.

Canada: **British Columbia**, Sechelt, tidal creek at Porpoise Bay (49°29'20.14"N, 123°45'54.14"W).

Norway. (no locality given).

USA: **North Carolina**, Brunswick Co. Sunset Harbor, mouth of Lockwood Folly R. (33°55'16.13"N, 78°13'59.65"W); Cartaret Co., Beaufort, shore of Newport R. at SR 1208 bridge to Piver's Island (34°43'11.25"N, 76°40'23.67"W); Pender Co. (Topsail Beach, Topsail Sound) (34°21'48.06"N, 77°37'46.23"W).

White Sea. (no locality given).

**Hosts.** Canada: *Limnoria lignorum* (Rathke) (pleopods). Norway: *L. lignorum*. USA: *L. tripunctata* Menzies (pleopods).

**References.** Jankowski 1986; Clamp 1988a.

### 3. Restricted to Decapoda

#### *L. callinectes* Couch, 1967

*Lagenophrys* sp. Couch 1966: 171, 172.

*Lagenophrys callinectes* Couch 1967: 204; Sprague 1970: 429; Sprague & Couch 1971: 533; Clamp 1973: 561; Couch 1973: 638-647; Felgenhauer 1982: 148.

**Museum Depositions.** USNM. 42344, 42345, 42346, 42347, 42348, 24239 Holotypes; 24240 Paratype.

**Habitat.** Marine, estuarine.

**Distribution.** BR: Nearctic, Neotropical (Mayén-Estrada & Aguilar-Aguilar 2012).

USA: **Florida**, Indian River Co., Vero Beach, W bank of Indian R. N of FLA 60 (27°38'16.43"N, 80°22'32.68"W); Near Pensacola, Gulf of Mexico. **Georgia**, estuaries. **Louisiana**, Gulf of Mexico, near New Orleans; S of Terrebonne Parish, Shipshoal lease area (Gulf of Mexico) (29°1'59.58"N, 90°44'52.3"W). **Maryland**, Chesapeake Bay. **North Carolina**, Cartaret Co., 26 km N Beaufort, Adams Cr.; Beaufort (34°57'7.34"N, 76°39'20.06"W). **South Carolina**, Charleston Co., Charleston, Wando R.; Trenchard's Inlet (32°45'2.45"N, 79°52'49.09"W). **Virginia**, Chincoteague Bay.

Venezuela: **L. Maracaibo**; Rio de los Pojaros 1 km upstream from L. Maracaibo.

**Hosts.** USA: *Callinectes sapidus* Rathbun, *C. bocourti* A. Milne-Edwards (gills), *Palaemonetes* sp. (gills). Venezuela: *C. bocourti*, *C. maracaiboensis* Taissoun, *C. sapidus* (gills).

**References.** Couch 1967, 1973; Clamp 1984, 1989; Messick 1998; Fernandez-Leborans & Tato-Porto 2000.

### *L. eupagurus* Kellicott, 1893

*Lagenophrys eupagurus* Kellicott 1893: 10; Wallengren 1900: 358; von Ubisch 1913: 43; Swarczewsky 1930: 457; Corliss & Brough 1965: 74; Kane 1965: 121; Couch 1966: 171; Couch 1967: 204; Sprague 1970: 427, 429; Sprague & Couch 1971: 533; Felgenhauer 1982: 148.

*Lagenophrys paguri* Kahl, 1935: 795.

*Lagenophrys lunatus* Imamura 1940: 268-270; Debaisieux 1959: 361-383; Corliss & Brough 1965: 74; Kane 1965: 121; Couch 1967: 210; Sprague 1970: 429; Sprague & Couch 1971: 533; Clamp 1973: 558-561; Couch 1978: 17, 19; Felgenhauer 1982: 142, 148, 149.

*Lagenophrys articularis* Nie & Ho 1943: 146, 147; Corliss & Brough 1965: 74; Kane 1965: 121; Couch 1967: 210; Sprague & Couch 1971: 531; Felgenhauer 1982: 142, 148.

*Lagenophrys* sp. Johnson 1974: 4, 12, 14; Johnson 1975: 14; Felgenhauer & Ridgeway 1977: 533-535.

*Lagenophrys* ("lunatus like") Felgenhauer 1982: 148, 149.

**Museum Depositions.** USNM. 42331, 42332, 42333, 42334, 42335, 42336, 42337, 42338, 42339, 42340, 42341, 42342, 42343.

**Habitat.** Marine, estuarine, freshwater.

**Distribution.** BR: Nearctic, Neotropical, Oriental, Palaearctic (Mayén-Estrada & Aguilar-Aguilar 2012).

Belgium: **Antwerpen**, Lillo (Anvers), ditches flooded by tides from Escaut R. (51°14'9.16"N, 4°23'0.23"E).

China: **Sichuan** (Szechwan) (30°33'18.53"N, 103°55'51.45"E); Beibei (Pehpei) (29°48'11.07"N, 106°23'44.05"E); pond near National Institute of Zoology and Botany, Academia Sinica (25°3'3.94"N, 121°37'18.02"E).

Japan: **Hokkaido**, Sapporo (no locality given).

Mexico: **Yucatán**, Dzilam (21°26'N, 88°56'W); Sisal (21°10'N, 90°02'W).

Thailand: **Bangkok**, Bang Sorn.

USA: **Arkansas**, Monroe Co. 6.3 mi. E Holly Grove, Big Cypress Creek at ARK 86 (34°36'7.09"N, 91°5'19.85"W). **Delaware**, Sussex Co., 7.2 km S Rehoboth Beach, Delaware Seashore State Park, Savage's Ditch. **Illinois**, Union Co., near Wolf Lake, Pine Hill Spring (37°30'23.30"N, 89°26'14.10"W); Coles Co., 2.5 mi. SE Charleston. **Louisiana**, Orleans Pa., 3.9 mi. SW Green's Ditch, Marquez Canal al Chef Menteur Pass. (30°4'8.32"N 89°48'2.98"W); St. Tammany Parish, 11.5 km SE Slidell, The Rigolets at US 90 (30°10'32.12"N, 89°43'47.43"W); Vermilion Pa., 7.6 mi. SSW Abbeville, Little Bayou at LA 82 (29°51'45.16"N 92°10'33.28"W). **Maryland**, Wicomico Co., Nanticoke, canal leading into Nanticoke R. **Massachusetts**, Barnstable Co., Sippewissett, Sippewissett Beach (41°33'30.70"N, 70°39'18.75"W); Woods Hole, Eel pond. **Mississippi**, Harrison Co., near Biloxi, extreme E end of Deer Island. **New Jersey**, Monmouth Co., Bay Head, salt marsh. **North Carolina**, Beaufort Co., south creek, small boat basin at confluence of Bond creek and Muddy Cr. (35°20'32.64"N, 76°41'27.52"W); Beaufort Co. 6.1 mi. NE Aurora, shallows of South Cr.; Cartaret Co., near Beaufort, Bird Shoal (mouth of Newport R.) (34°42'29.29"N, 76°39'33.75"W); Cartaret Co. 9.3 mi. N Atlantic Cedar Island, Pamlico Sound (35°8'4.71"N, 76°19'7.91"W); Cartaret Co., Morehead City, Bogue Sound; Cartaret Co., 3 mi. ESE Newport, Newport R. at mouth of Black Cr., Cartaret Co., Morehead City, Calico Cr., Cumberland Co.,



Fort Bragg Military Reservation, Texas L.; Dare, Co. Stumpy Point, Stumpy Point Bay at end SR 1100 (35°42'32.12"N, 75°43'11.39"W); Dare Co. Bodie Island, 1.6 mi S jct. US 64 with US 264, creek at NC 12 (35°53'2.95"N, 75°35'24.49"W); Dare Co., Hatteras Island, 0.5 mi. N Waves, creek at NC 12 (35°34'39.89"N 75°28'2.50"W); Dare Co., Hatteras Island just S Salvo Town limit, creek at NC 12 (35°32'7.63"N, 75°28'24.44"W); Dare Co., Hatteras Island, 1.5 mi. NNE Buxton Center (35°16'51.86"N, 75°31'2.08"W); Pamlico Sound (35°14'42.97"N, 75°59'30.03"W); Hyde Co. 1.0 mi S Fairfield Lake Mattamuskeet at NC 94 causeway (35°31'38.80"N, 76°13'9.07"W); Hyde Co., Ocracoke Island, 4.3 mi. ENE Ocracoke, Quork's Point Cr. at NC 12 (35°8'2.59"N, 75°54'30.84"W); Hyde Co., Ocracoke Island, 5.5 mi NE Ocracoke, Molasses Cr. at NC 12 (35°8'35.12"N, 75°53'9.60"W); New Hanover Co., Wrightsville Beach, Wrightsville Sound (34°12'30.49"N, 77°47'47.31"W); Onslow, Co., West Onslow Beach, brackish ponds at N end of Topsail Island (34°28'45.18"N, 77°27'14.07"W); Pender Co., New Topsail Beach, Topsail Sound (34°22'4.84"N, 77°37'51.09"W); Tyrrell Co., Gum Neck Landig, public boating access area at end SR 1316 (35°41'34.81"N, 76°6'49.78"W); Wake Co., 5.0 mi. SW Raleigh center, Yates Mill Pond (35°43'14.12"N, 78°41'20.68"W). **Texas**, aquaculture ponds; Brazoria Co., ponds of Texas A & M University shrimp culture project (30°36'44.63"N, 96°21'11.12"W). **Virginia**, Accomack Co., 2.3 mi. Chincoteague, Queen Sound at VA 175; Accomack Co., Chincoteague Bay.

**Hosts.** Belgium: *Palaemonetes varians* (Leach) (all surfaces of body except gills). China: *Macrobrachium nipponense* (cited as *Macrobrachium nipponensis*) (antennae and pleopods). Japan: *Palaemon paucidens* de Haan (uropods, carapace, terga, maxillipeds, pleopods, basal parts of antennae, and eyestalks) (also cited as *Leander paucidens* and *Palaemonetes paucidens*). Mexico: *Farfantepenaeus brasiliensis* (Latreille) (gills), *Palaemonetes pugio* Holthuis (gills). Thailand: *Macrobrachium rosenbergii* (de Man) (gill lamellae). USA: *Apocorophium acutum* (Chevreux) (cited as *Corophium acutum*) (gills), *Pagurus longicarpus* Say (gill lamellae), *Palaemonetes intermedius* Holthuis, *P. kadiakensis* Rathbun, *P. paludosus* (Gibbes), *P. pugio*, *P. vulgaris* (Say), *Palaemonetes* sp. (all surfaces of body), *Macrobrachium ohione* (Smith) (medial surfaces of pleura), *Litopenaeus setiferus* (Linnaeus) (cited as *Penaeus setiferus*), *Litopenaeus vannamei* (Boone) (cited as *Penaeus vannamei*), *Upogebia affinis* (Say) (all surfaces of body).

**References.** Imamura 1940; Debaisieux 1959; Clamp 1984; 1989; Fernandez-Leborans & Tato-Porto 2000; Vidal-Martínez *et al.* 2002.

## II. *Paralagenophrys* Clamp, 1987

### *P. singularis* (Kellicott, 1887)

*Lagenophrys singularis* Kellicott 1887: 187-188; Wallengren 1900: 358; Swarczewsky 1930: 457; Kahl 1935: 797.

**Museum Deposition.** USNM. 39507.

**Habitat.** Freshwater.

**Distribution.** BR: Nearctic.

USA: **Arkansas**, Arkansas Co., 6.6 mi S Gilett, Moore Bayou at ARK 1 (34°1'52.39"N, 91°22'29.40"W).

**Maryland**, Wicomico Co., Powelville, Adkin's Mill Pond (38°19'56.33"N 75°22'28.08"W). **North Carolina**, Avery Co., 1.2 mi S Crossnore, Linville R. at SR 1536 (36°0'15.79"N, 81°56'0.78"W); Brunswick Co., 2.3 mi. SW Belville, Jackey's Cr. At NC 133 (34°11'58.04"N 77°58'51.61"W); Columbus Co., Tabor City, Spivey's Pond (34°8'24.83"N, 78°49'21.16"W); Columbus Co., Lake Waccamaw, canal near northwest shore of L. Waccamaw (34°17'26.58"N 78°28'27.09"W); Cumberland Co., 6.7 mi NW Hope Mills, pond at Lake Rim State Fish Hatchery (35°1'53.78"N, 79° 2'25.05"W); Duplin Co., near Kenansville, Tea Swamp at NC 50 (34°57'12.30"N 77°57'10.27"W); Johnston Co., 1.5 mi W Princeton, Holt's Pond (35°27'56.78"N, 78°11'12.80"W); Johnston Co., 3.0 mi NE Four Oaks, Holt's L. at NC 96 (35°28'9.76"N, 78°23'4.89"W); Moore Co., near Vass, farm pond (35°15'30.27"N, 79°17'20.56"W); Tyrrell Co., 0.6 mi S Columbia, ditch alongside NC 94 (35°54'33.19"N, 76°14'50.81"W).

**Hosts.** USA: *Cambarus* (*Cambarus*) *bartonii bartonii* (cited as *Cambarus bartonii*) (carapace), *Lemna* sp. (underside of leaves), on leaves of moss attached to bases of cypresses, *Ludwigia* sp. (underside of leaves), *Amnicola* sp. (external surface of shell), unidentified aquatic vascular plant (underside of leaves), *Myriophyllum* sp. (rotting plant debris), *Utricularia* sp. (rotting plant debris).

**References.** Clamp 1987b.

## III. *Clistolagenophrys* Clamp, 1991

### A. Occurring Only In Freshwater

**1. Northern Hemisphere**  
**a. Restricted to Amphipoda**  
**i. Lake Baikal endemics**

***C. primitiva* (Swarzewsky, 1930)**

*Lagenophrys primitiva* Swarzewsky 1930: 464, 480-483, 493-503; Kahl 1935: 799; Kane 1965: 121.

**Habitat.** Freshwater.

**Distribution.** BR: Palaearctic.

Russia: **Lake Baikal**, Irkutsk (52°16'30.18"N, 104°18'12.29"E).

**Hosts.** Russia: *Pallasea cancellus* (pereiopods, pleopods).

**References.** Swarzewsky 1930; Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

**IV. *Setonophrys* Jankowski, 1986**

**1. Australia only, Freshwater, Restricted to Decapoda.**

***S. bispinosa* (Kane, 1965)**

*Lagenophrys bispinosa* Kane 1965: 109, 117, 120, 121.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **New South Wales**, stream near Newcastle (32°56'30.47"S, 151°46'17.52"E).

**Hosts.** Australia: *Cherax rotundus setosus* (swimmerets).

**References.** Kane 1965; Fernandez-Leborans & Tato-Porto 2000.

***S. communis* (Kane, 1965)**

*Lagenophrys communis* Kane 1965: 109, 117, 120, 121; Sprague & Couch 1971: 533.

*Lagenophrys latispinosa* Kane 1965: 109, 118, 120, 121; Sprague & Couch 1971: 533.

*Lagenophrys lawrii* Kane 1965: 109, 118, 120; Sprague & Couch 1971: 533.

**Museum Depositions.** USNM. 42125, 42676, 42677, 42678, 42679.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **New South Wales**, Euston, Murray river (34°34'40.56"S, 142°44'47.49"E); near Newcastle, waterhole (32°56'19.32"S, 151°46'25.63"E); Wentworth, Murray river at Lock 10 (34°26'2.12"S, 142°10'48.87"E).

**Northern territory**, Groote Eylandt (Island in Gulf of Carpentaria, NE end of island on side of Little Lagoon (13°56'17.09"S, 136°44'40.81"E); near Darwin, stream (12°26'26.92"S, 130°52'3.73"E). **Victoria**, Apollo Bay; 9 mi. ESE Healesville (37°44'2.89"S, 145°38'54.87"E); Brahma Ferry (34°47'15.19"S, 138°32'38.95"E); Craigburn, Merri Creek (37°42'33.29"S, 144°58'52.11"E); dams around Melbourne, Panton Hill (37°38'43.19"S, 145°14'32.49"E); Heathcote, Hamilton (36°55'0.23"S, 144°42'29.64"E); Maryborough (37°2'49.00"S, 143°44'13.28"E); 15 mi. N Orbost (37°30'46.11"S, 148°27'10.29"E); Panton Hill (20 mi. northeast of Melbourne) (37°39'39.10"S, 145°17'29.68"E).

**Hosts.** Australia: *Cherax albidus* (gills), *C. destructor* (exposed surfaces of body and gills), *C. quadricarinatus* (gills), *Engaeus marmoratus* (gills), *Engaeus* sp., *Euastacus armatus* (Clark) (gills), *E. nobilis* (Dana), *Synamphisopus ambiguous* (Sheard).

**References.** Kane 1965; Clamp 1984, 1991; Fernandez-Leborans & Tato-Porto 2000.

***S. lingulata* (Kane, 1965)**

*Lagenophrys lingulata* Kane 1965: 109, 118, 120, 121.

**Museum Depositions.** USNM. 42680 Neotype; 42681 42682.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **New South Wales**, Wentworth, Murray river at Lock 10 (34°26'2.12"S, 142°10'48.87"E); Queensland (20°55'58.47"S, 142°42'3.27"E). **Victoria**, Brahma Ferry (34°47'15.19"S, 138°32'38.95"E); Craigieburn, Merri Creek (27 km north of Melbourne) (37°34'17.95"S, 144°57'39.34"E); Heathcote (36°55'0.23"S, 144°42'29.64"E); Maryborough (37°2'49.00"S, 143°44'13.28"E); Merri Creek (Merri Merri Creek) is a tributary of the Yarra River (37°34'17.95"S, 144°57'39.34"E); near Melbourne (37°37'32.24"S, 144°54'28.31"E).

**Hosts.** Australia: *Cherax albidus*, *C. depressus* Riek, *C. destructor* (gills). New South Wales: *C. rotundus* (gills).

**References.** Kane 1965; Clamp 1984, 1991; Fernandez-Leborans & Tato-Porto 2000.

***S. nivalis* (Kane, 1969)**

*Lagenophrys nivalis* Kane 1969: 369.

*Circolagenophrys nivalis* Jankowski 1986: 87.

*Setonophrys nivalis* Clamp 1991: 360.

**Museum Depositions.** AM P62819 Lectotype; P62820, P62884, P62885 Paralectotypes. USNM. 1004292 Paralectotype.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Victoria**, Mt. Baw (37°51'22.95"S, 146°16'10.16"E).

**Hosts.** Australia: *Colubotelson searlei* Nicholls (pereopods and dorsum).

**References.** Clamp & Kane 2003.

***S. occlusa* (Kane, 1965)**

*Lagenophrys occlusa* Kane 1965: 118-119, 120, 121.

**Museum Deposition.** USNM. 42683.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **New South Wales** (31°15'27.30"S, 146°55'15.61"E). **Victoria**, Craigieburn, Merri Cr. (37°34'17.95"S, 144°57'39.34"E); Grampian Mountains, Wannon R. (37°31'35.60"S, 142°11'29.73"E); Heathcote (36°55'0.23"S, 144°42'29.64"E); Maryborough (37°2'49.00"S, 143°44'13.28"E); Victoria Central (37°29'11.16"S, 144°48'31.00"E); West Victoria (37°48'29.38"S, 144°11'12.38"E).

**Hosts.** Australia: *Cherax albidus*, *C. destructor* (branchial cavity), *Geocharax falcata* (gills). New South Wales: *Cherax rotundus* (branchial cavity).

**References.** Kane 1965; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

***S. seticola* (Kane, 1965)**

*Lagenophrys seticola* Kane 1965: 109, 119-120, 121.

**Museum Deposition.** USNM. 42684 Neotype.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **New South Wales**, Newcastle (32°56'30.47"S, 151°46'17.52"E). **Victoria**, Grampian Mountains, Wannon River (37°31'35.60"S, 142°11'29.73"E); Melbourne, Templestowe, bank of Yarra River (37°45'12.16"S, 145°13'19.17"E); Warburton.

**Hosts.** Australia: *Cherax albidus*, *C. destructor*, *C. rotundus setosus* (setae), *Engaeus fultoni* (setae), *Engaeus* sp. (setae), *Euastacus nobilis* (setae), *Geocharax falcata* (setae of pleopods).

**References.** Kane 1965; Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

***S. spinosa* (Kane, 1965)**

*Lagenophrys spinosa* Kane 1965: 109, 117, 120, 121.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Melbourne**, Heathcote, 50 miles north of Melbourne (37°4'52.26"S, 144°52'22.02"E).

**Hosts.** Australia: *Cherax destructor* (exposed parts).

**References.** Kane 1965; Clamp 1984; Fernandez-Leborans & Tato-Porto 2000.

***S. tricorniculata* Clamp, 1991**

**Museum Deposition.** USNM. 42685 Holotype.

**Habitat.** Freshwater.

**Distribution.** BR: Australia.

Australia: **Victoria**, Grampian Mountains, Wannon River (37°34'30.84"S, 142°15'26.08"E).

**Hosts.** Australia: *Geocharax falcata* (pleopods).

**References.** Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

**V. *Operculigera* Kane, 1969**

**A. Australia only (Restricted to Isopoda)**

***O. haswelli* Clamp and Kane, 2003**

**Museum Depositions.** AM P62814 Holotype; P62815 Paratype. USNM. 1004288 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Tasmania**, Great Lake (41°54'4.67"S, 146°45'52.48"E).

**Hosts.** Australia: *Mesacanthotelson tasmaniae* (Thomsom) (pleopods).

**References.** Clamp & Kane 2003.

***O. inornata* Clamp and Kane, 2003**

**Museum Depositions.** AM P62816 Holotype; P62817, P62818 Paratypes. USNM. 1004289, 1004290, 1004291 Paratypes.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Victoria**, Otway Range (38°47'36.74"S, 143°32'31.24"E); Grampian Range, swamp near Fyan's creek (37°5'17.77"S, 142°33'43.84"E). **Tasmania**, Great Lake (41°54'4.67"S, 146°45'52.48"E).

**Hosts.** Australia: *Phreatoicopsis terricola* Spencer and Hall, *Phreatoicopsis* sp. (pleopods), *Colubotelson chiltoni* (Sheppard) (pleopods).

**References.** Clamp & Kane 2003.

***O. montanea* Kane, 1969**

*Operculigera montanea* Kane 1969: 369; Jankowski 1986: 82, 83; Clamp 1991: 365.

**Museum Depositions.** AM P62810 Lectotype; P62811 Paralectotype. USNM. 1004287 Paralectotype.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Victoria**, summit of Mt Baw (37°51'22.95"S, 146°16'10.16"E); Mt. Buffalo (36°43'39.52"S, 146°49'22.15"E); Kiewa (36°15'40.86"S, 147°0'30.09"E).

**Hosts.** Australia: *Colubotelson joyneri* (Nicholls) (pleopods), *C. searlei* (pleopods), *Colubotelson* sp.

**References.** Kane 1969; Fernandez-Leborans & Tato-Porto 2000; Clamp & Kane 2003.

***O. obstipa* Clamp, 1991**

**Museum Depositions.** USNM. 42694 Holotype; 42695 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **New South Wales**, Mt. Kosciusko (36°28'13.31"S, 148°15'55.34"E).

**Hosts.** Australia: *Metaphreatoicus australis* (Chilton) (pleopods).

**References.** Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

***O. zeehanensis* Kane, 1969**

**Museum Depositions.** AM P62813 Lectotype.

**Habitat.** Freshwater.

**Distribution.** BR: Australian.

Australia: **Tasmania**, near Zeehan (145°20'3.19"E 145°20'3.19"E).

**Hosts.** Australia: *Phreatoicoides longicollis* Nicholls (pleopods).

**References.** Kane 1969; Clamp & Kane 2003.

**B. South America only (Restricted to Decapoda)**

***O. asymmetrica* Clamp, 1991**

**Museum Depositions.** USNM. 42687 Holotype; 42689, 42691 Paratypes.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Concepción**, Concepción (36°49'37.73"S, 73°3'4.23"W); Talcahuano (36°43'27.98"S, 73°6'45.63"W).

**Hosts.** Chile: *Parastacus pugnax* (Poëppig), *Samastacus spinifrons* (Philippi) (gills).

**References.** Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

***O. insolita* Clamp, 1991**

**Museum Depositions.** USNM. 42692 Holotype; 42693 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Concepción**, Talcahuano (36°43'27.98"S, 73°6'45.63"W). **Malleco**, Puren (38°2'33.95"S, 73°5'11.39"W).

**Hosts.** Chile: *Parastacus pugnax* (gills).



**References.** Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

***O. parastacis* Jankowski, 1986**

**Museum Deposition.** USNM. 42686.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Valparaíso** (33°2'34.52"S, 71°37'10.21"W).

**Hosts.** Chile: *Parastacus pugnax* (cited as *Parastacus chilensis*) (gills).

**References.** Jankowski 1986.

***O. seticola* Clamp, 1991**

**Museum Depositions.** USNM. 42688 Holotype; 42690 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Concepción**, Concepción (36°49'37.73"S, 73°3'4.23"W).

**Hosts.** Chile: *Parastacus pugnax* (setae on bases of gills).

**References.** Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

***O. striata* Jankowski, 1986**

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Valparaíso** (33°2'34.52"S, 71°37'10.21"W).

**Hosts.** Chile: *Parastacus pugnax* (cited as *Parastacus chilensis*) (gills).

**References.** Jankowski 1986; Fernandez-Leborans & Tato-Porto 2000.

***O. taura* Clamp, 1991**

**Museum Depositions.** USNM. 42696 Holotype; 42697 Paratype.

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Concepción**, Concepción (36°49'37.73"S, 73°3'4.23"W). Malleco, Puren (38°2'33.95"S, 73°5'11.39"W).

**Hosts.** Chile: *Parastacus pugnax* (gills).

**References.** Clamp 1991; Fernandez-Leborans & Tato-Porto 2000.

***O. velata* Jankowski, 1986**

**Habitat.** Freshwater.

**Distribution.** BR: Neotropical.

Chile: **Valparaíso** (33°2'34.52"S, 71°37'10.21"W).

**Hosts.** Chile: *Aegla laevis* (Latreille) (gills).

**References.** Jankowski 1986; Fernandez-Leborans & Tato-Porto 2000.

**C. Madagascar only (Restricted to Decapoda)**

***O. carcini* Clamp, 1992**

**Museum Depositions.** USNM. 43099 Holotype; 43100, 43101 Paratypes.

**Habitat.** Freshwater.

**Distribution.** BR: Ethiopian.

Madagascar: central part (19°13'28.96"S, 46°41'32.86"E).

**Hosts.** Madagascar: *Foza goudoti* (cited as *Gecarcinautes goudoti*) (gills).

**References.** Clamp 1992.

***O. madagascarensis* Clamp, 1992**

**Museum Depositions.** USNM. 43094 Holotype; 43095, 43096, 43097, 43098 Paratypes.

**Habitat.** Freshwater.

**Distribution.** BR: Ethiopian.

Madagascar: **Antananarivo** (18°55'41.60"S, 47°32'23.26"E) (bought in marketplace).

**Hosts.** Madagascar: *Astacoides granulimanus* Monod and Petit (gills) (cited as *Astacoides madagascarensis granulimanus*).

**References.** Clamp 1992.

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